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Fire-Fighting Operations

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FIRE-FIGHTING OPERATIONS

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Preface

The purpose of this field manual (FM) is to give a commander and members of fire-fighting teams direction on deploying and using engineer fire-fighting teams. Engineer fire-fighting teams will provide fire-prevention/-protection, aircraft-crash/rescue, natural-cover, and hazardous-material (HAZMAT) (incident) responses within a theater of operations (TO). Normally, there will not be enough fire-fighting assets within the TO. Therefore, commanders must prioritize assets and facilities that are mission-essential and deploy fire-fighting assets accordingly. This manual will not provide the answer to every possible incident scenario. It will, however, provide a commander and fire-fighting teams the knowledge to make informed, timely, and confident decisions at an incident. If more specific technical guidance is needed, individuals should acquire the appropriate technical order, technical manual, or International Fire Service Training Association (IFSTA) manual.

Appendix A contains an English-to-metric-measurement conversion chart.

Unless otherwise stated, *fire-fighting teams* refers to military engineer fire-fighting teams.

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Unless otherwise stated, masculine pronouns do not refer exclusively to men.

Chapter 1

Fire-Fighting Basics

1-1. All levels of command are responsible for the Army's fire-protection plan. All commanders and supervisors must be responsible for the fire-safety policies and plans in their organizations. They must be aware of fire safety in all endeavors of life.

THREAT

1-2. Fire-fighting teams are not priority targets, but they may become targets of opportunity because of their location in relation to other mission-essential facilities. In low-level conflicts, fire-fighting teams become targets because of the response into the public domain. Fire-fighting units have no organic security assets. During fire-fighting operations, all crew members are engaged in the operations. Because of this, security must be provided for during response, retrieval, and fire-fighting operations.

TRAINING

1-3. Fire-fighting teams are manned by qualified military occupational specialty (MOS) 51Ms. The Basic Fire-Protection Apprentice Course (51M advanced individual training [AIT]) is currently conducted at Goodfellow Air Force Base (AFB), Texas (TX), and is 13 weeks long. Other advanced, specialized courses are taught there as well.

1-4. During garrison operations, engineer fire-fighting teams will be operationally assigned to an installation's fire department. This will allow the 51M firefighters to practice and train with an installation's firefighters to maintain skills, knowledge, and performance according to their mission-essential task list (METL).

SUPPORTING FORCE XXI

1-5. Fire-fighting teams will support Force XXI by providing fire protection to deployed forces throughout the world in areas of operation (AOs) where the current infrastructure has collapsed or is in such deterioration that it cannot support the United States' (US) interests. The number and types of fire-fighting teams needed to protect an AO will depend on its size and the type of facilities in that AO. Chapters 2 and 3 address the issue of fire-fighting teams. Consider the following guidelines when planning for fire-protection requirements:

- Aviation (unit support)—one LB team per air-traffic services company.
- Airfield (point support)—two LB teams per fixed airfield and heliport (UH-60, AH-64, CH-47).

- Supply (area support)—one LB team for each of the following: 5 square miles of AO, corps support group (CSG), division support area (DSA), area support group (ASG), corps storage area (CSA), and theater storage area (TSA).
- Ammunition (point support)—one LB team for each of the following: ammunition supply point (ASP), nuclear ammunition supply point (NASP), and chemical ammunition supply point (CASP).
- Petroleum, oils, and lubricants (POL) (point support)—two LB teams per petroleum supply company and two per petroleum pipeline/ terminal operations company.
- Internment/dislocated civilian camp (point support)—one LB team per internment/dislocated civilian camp.
- Contingency operations—one LB team per 5 square miles of AO.
- Natural cover/brush—two LB teams per ASG.

NOTE: Each LB team requires one LC team for water supply.

MISSION STATEMENT

1-6. On the 24-hour concept and according to existing directives (the commander's priority list and mission requirements), engineer fire-fighting teams will provide fire-prevention/-protection, aircraft-crash/rescue, natural-cover-fire, and HAZMAT responses within a TO. The teams will—

- Conduct fire-prevention inspections and fire-fighting operations.
- Provide first-responder-level medical response and assistance to victims.
- Provide an initial response to HAZMAT incidents.
- Set up, operate, and maintain a 24-hour-a-day, fire-department communications network.
- Conduct POL fire-fighting operations.
- Conduct reconnaissance of the water-supply points.
- Provide water resupply to the fire-fighting teams.
- Maintain the emergency water-supply points.
- Provide additional manpower support to the fire-fighting teams.
- Provide command and control (C^2) of non-fire-fighting assets used when supporting brush fire-fighting operations.
- Conduct crash/rescue operations, provide support for normal flight and maintenance operations, and support medical-evacuation (MEDEVAC) operations.

Chapter 2

Organization, Responsibilities, and Equipment

2-1. This chapter lists the fire-fighting organizational chain of command and its responsibilities. The composition and makeup of the fire-fighting teams are also addressed. With this information, a commander in a TO will know what his fire-fighting resources are and how to use them.

ORGANIZATIONS

2-2. The agencies listed below provide regulatory guidance (doctrine, directives, policies, and so forth), command and supervision, quality control, logistics, and training guidance for all units needing this information.

DEPARTMENT OF THE ARMY

2-3. DA supervises the fire-protection program by—

- Developing, reviewing, and publishing directives, procedures, standards, and policies.
- Conducting staff visits to major and intermediate commands and selected representative bases.
- Reviewing and analyzing fire-incident reports from the installations.

ENGINEER BRANCH

2-4. The chief of engineers coordinates the training of fire-protection units and provides a link with other DA agencies, Air Force civil engineers, and the Navy Bureau of Yards and Docks. The USAES is responsible for doctrine, combat development, new equipment, training, and military fire-fighting-personnel issues. The Air Force is the executive agency for fire-fighting training conducted at the Department of Defense's (DOD's) Fire Protection School at Goodfellow AFB, TX.

MAJOR COMMAND

2-5. Each commander is responsible for the fire-protection program on his installation. If an installation has two or more commands, the host command is responsible for the program. The command supervises the fire-protection program by using directives from higher headquarters (HQ) and by using command-channel communications. Fire-protection operational-readiness inspections (FPORIs) are conducted no less than every 36 months, unless special problems arise. An installation's fire marshal—

- Is the staff officer responsible for carrying out an installation's fire-protection program.
- Is responsible for staff supervision over an installation's fire-protection organizations.

- Coordinates fire-protection matters with all other activities on an installation.

FIRE-PREVENTION/-PROTECTION PROGRAMS

2-6. Fire-prevention personnel establish standards and practices for preventing accidental fires. They use surveys and inspections to monitor compliance to these standards and recommend corrective action or penalties for noncompliance. The fire-protection personnel perform fire-rescue/crash-rescue operations, HAZMAT operations, and fire-suppression operations.

FIRE-FIGHTING TEAMS

2-7. Personnel in these teams provide fire-prevention and fire-protection services for deployed forces in stability operations and support operations. The teams are used when host nation (HN) fire-protection support cannot provide adequate protection or is nonexistent. The teams protect internal and external (HN and other US services) Army assets. They maintain fire-protection equipment, advise the higher commanders of fire-defense plans, and train auxiliary firefighters as required. The fire-fighting teams are LA, LB, LC. They are designed to provide task-oriented support, depending on the tactical and logistical considerations involved. See Chapter 3 for more information on these teams.

TEAM LA, FIRE-PROTECTION HQ

2-8. This team provides C^2/administrative support. One LA team can control three to seven fire-fighting teams (LB or LC). A team commander serves as the fire marshal of an installation/a facility or within his area of responsibility. An LA team's missions are to—

- Plan for fire defense on an installation.
- Conduct fire-prevention inspections.
- Conduct fire investigations.
- Establish a fire-department communications network between the HQ, the military police (MP), the airfield, and the fire-fighting teams.
- Command the fire-fighting teams.
- Maintain and refill fire extinguishers.
- Make minor repairs to fire hoses.
- Inspect and maintain fixed fire-protection systems on an installation/ in an AO.
- Coordinate the resupply of fire-fighting assets, agents, self-contained breathing apparatus (SCBA) air, and fuel.
- Coordinate mutual aid with other services/HN fire-protection assets.

TEAM LB, FIRE TRUCK

2-9. This team provides fire protection, administers first aid, provides an initial response to HAZMAT incidents, and implements a fire-prevention

program. A commander's primary task list determines the team's assignments. An LB team's missions are to—

- Provide crash/rescue support for MEDEVAC and normal flight or maintenance standbys.
- Conduct fire-prevention inspections on an installation or airfield.
- Provide C^2 of the non-fire-fighting assets used to support natural-cover fire-fighting operations (heavy equipment, personnel).
- Conduct fire-fighting operations (structural, crash/rescue, and natural cover) on an installation/in an AO.
- Provide emergency medical assistance to victims.
- Conduct an initial response to HAZMAT incidents.
- Conduct the training of unit-level fire brigades.
- Assist with medical resources during mass casualty incidents.
- Assist in HN support (HNS), as a commander requires.

TEAM LC, WATER TRUCK

2-10. This team transports water to resupply fire-fighting teams when a fixed water supply is not in place. It also supplies manpower to fire-fighting teams. One LC team is assigned to each LB team. An LC team's missions are to—

- Conduct water-resupply support to the fire-fighting teams.
- Provide additional manpower support to the fire-fighting teams.
- Conduct reconnaissance of the water-resupply points.
- Maintain the emergency water-supply points.
- Assist in HNS, as a commander requires.

FIRE-PROTECTION PERSONNEL

2-11. An installation's fire department employs military and civilian personnel. Manpower resources and Army manpower policies determine the number of military and civilian personnel assigned to a fire department. The duties and responsibilities for military firefighters are outlined in Army Regulation (AR) 611-201 and for civilian firefighters in *Handbook of Occupational Groups and Series*.

FIRE-FIGHTING DRILLS

2-12. Firefighters practice hose, ladder, and pump drills, under simulated conditions, to achieve a high proficiency level. The drills must be varied so that the firefighters use all the fire-protection equipment. In each drill, firefighters have a series of assignments that they must execute quickly and precisely. These assignments involve laying out hose lines, putting a pump into operation, and erecting ladders on buildings. Firefighters should conduct these drills during peacetime and when operating in secured areas during deployment. They must conduct the drills to become familiar with the new

equipment and operations that they may need when they deploy to or with units that require their support apart from normal missions. AR 420-90 outlines refresher drills for firefighters.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

2-13. All firefighters deploying to a TO must have the required PPE to perform their assigned duties safely and effectively. A detachment's sergeant (SGT) must ensure that—

- All firefighters have all of their required PPE in serviceable condition.
- Any shortages and unserviceable PPE are reported to the commander and replaced before deploying.
- All commanders are aware of every item of PPE that is required for normal performance of the firefighters' duties, to include special protective clothing that they may need for a mission (HAZMAT suits, for example).

2-14. At a minimum, firefighters are authorized one set of structural turnouts and one set of aluminized proximity gear. They should have both sets when they deploy. (The aluminized proximity gear does not absorb chemicals and would be better than structural gear if they encounter HAZMAT situations.) The following items constitute a full set of personal protective clothing:

- Structural—fire-fighting helmet with (w/) shield; NOMEX or PBI/ kevlar hood, turnout coat, and turnout trousers w/suspenders; leather fire-fighting gloves; rubber fire-fighting boots; positive-pressure SCBA; and personal alert safety system (PASS).
- Crash—aluminized proxmity helmet w/tinted shield, aluminized proximity coat and trousers w/suspenders, aluminized proximity gloves, rubber fire-fighting boots, positive-pressure SCBA, and PASS.

NOTES:

1. Never use structural or proximity gear as a replacement for the proper HAZMAT protective gear. Many chemicals can be lethal if absorbed or inhaled in very small quantities. If you cannot positively identify a HAZMAT, do not compromise your crew's safety with inadequate protective clothing.

2. All personal protective clothing must meet the current National Fire Protection Association (NFPA) standards for that particular item.

FIRE-FIGHTING EQUIPMENT

2-15. Fire-fighting tools and equipment (such as fire trucks, water tankers, aerial ladders, hoist tools, hose, and pike poles) have been specifically designed for use in fire-fighting operations. The type of fire station, the primary mission of the fire department, or any unusual requirements of an installation or surrounding community will generally dictate the type of tools and equipment that a fire station should have. Training and practice drills encompassing all facets of fire-fighting operations should be conducted,

emphasizing that firefighters gain proficiency with the different tools and equipment available at their particular fire station.

FIRE TRUCKS

2-16. Fire departments use several types of fire trucks. The pumping capacities of these trucks range from 500 to 1,000 gallons per minute (GPM). Fire-department personnel must consider the location, construction, population, property value, existing safeguards, and availability of outside fire-protection assistance when selecting the types of trucks needed on an installation.

MODEL 2500L MILITARY-ADAPTED COMMERCIAL ITEM (MACI) FIRE TRUCK

2-17. This truck is the standard issue for the LB team and is designed for fire-fighting operations such as structural, crash, fuel, and brush fires on military installations. The rugged suspension and four-wheel-drive capability provide traction in all terrain conditions. The MACI can be driven on or off a C-130 and a C-141 aircraft without being dismantled, or it can be air-lifted by helicopter.

2-18. The MACI is equipped with a midship-mounted pump with a flow rate up to 1,000 GPM at 150 pounds per square inch (psi) of pressure. It is equipped with a 660-gallon water tank and 72-gallon foam tank. The foam system provides up to 6,000 US gallons (USG) of expanded foam with a 10:1 expansion ratio. At aircraft fires, the foam is pumped from the roof-mounted turret at 500 GPM or from the bumper turret at 250 GPM. The pump can be engaged at speeds of up to 30 miles per hour (mph) and will function at full capacity while the vehicle is maneuvered.

2-19. An on-board auxiliary power unit (APU) provides electrical power and drives a recirculating pump in temperatures below 60 degrees Fahrenheit (^{o}F). A diesel-fired water heater provides heated fluid, which is circulated through heat exchangers in the water tank, foam tank, drive engine’s cooling system, fuel tank, and cab's heating system. The truck has removable equipment to fight structural and brush fires and to handle crash/rescue emergencies. See Technical Manual (TM) 5-4210-220-12 for more information on the MACI.

MODEL A/S230-19 CRASH TRUCK

2-20. This truck is designed primarily for aircraft crash/rescue operations; however, it can be used to fight natural-cover and structural fires. The truck has a 1,000-gallon water tank and a 130-gallon foam tank. The P-19 has a Hale (50 FO-P), single-stage centrifugal pump that delivers 950 GPM at 200 psi. The fire pump is powered by an air-operated power divider and has an in-cab selector for either the water- or the foam-operating mode. The P-19 is also equipped with a Halon system that has a 500-pound agent tank (Halon 1211), a 110-cubic-foot nitrogen cylinder, a pressure regulator, four control valves and associated piping, and a 100-foot hose with a Halon nozzle.

2-21. The truck is powered by an in-line, six-cylinder, four-cycle diesel engine. This unit is equipped with a turbocharger and an after cooler for smooth, powerful operation. The P-19 is designed to operate on various types of terrain

and obstacles. See TM 5-4210-219-10 for more information on operating this truck.

TACTICAL TANKER TRUCK

2-22. This truck is standard issue for the LC team. It consists of an M916 tractor and a 6,000-gallon water distributor tank trailer. The trailer is equipped with an auxiliary engine and a water pump with a rated capacity of 600 GPM. It can equip a 1- to 1 1/2-inch hand line.

COMMERCIAL STRUCTURAL PUMPER TRUCK

2-23. This truck is mounted on a 4-by-2 chassis. It is designed for combating structural fires on continental US (CONUS) installations. The truck has a midship-mounted pump that delivers 1,000 GPM at 150 psi. It has a 400-gallon water tank, a 55-gallon aqueous film-forming foam (AFFF) tank, and a complete set of fire-fighting equipment. See the operator's manual for more information on this truck.

MINI-PUMP TRUCK

2-24. This truck is mounted on a 4-by-4 chassis. It has a 300-gallon water tank and a power take-off (PTO) pump that delivers 250 GPM. The truck is designed for an initial attack on structural, natural-cover, and small fires. See the operator's manual for more information on this truck.

COMMERCIAL TANKER

2-25. This tanker is mounted on a 4-by-4 chassis. It is equipped with a 1,000-gallon water tank and a PTO pump that delivers 250 GPM. This tanker is used in all fire emergencies and supplies water for the other trucks. See the operator's manual for more information on this tanker.

SKID-MOUNTED PUMPING UNIT

2-26. This unit is self-contained and has a power plant and pump that delivers 500 GPM. It has a water tank mounted on skids. When mounted on a standard Army 5-ton truck, the unit is used to combat brush fires in areas that are inaccessible to fire trucks. This unit can draft water from ponds, lakes, rivers, and streams or from erected folding water tanks that tankers supply.

OTHER VEHICLES

2-27. Other vehicles used in fire fighting may include transportation-motor-pool (TMP) vehicles, jeeps, helicopters, sedans, carry-all vans, and HAZMAT vehicles.

MAINTENANCE

2-28. To keep a fire truck in good working order, frequent inspections and preventive maintenance must be performed. Guidelines on inspections and maintenance are found in the appropriate TMs or operator's manuals. Maintenance inspections are performed daily and after each emergency. Maintenance will be done quarterly. The status of a vehicle and any deficiencies are recorded on DA Forms 5379-R and 2404. Annually, each truck

will be flow-tested. Each truck's pump capacity must meet the standards set by the manufacturer. The guidelines for flow testing are in IFSTA Manual 106.

Chapter 3

Command and Control

3-1. An LA team provides C^2 and administrative support for three to seven fire-fighting teams and coordinates engineer fire-fighting activities within a TO. When an LA team is not deployed, the senior firefighter of an LB or LC team provides C^2. All fire-fighting teams depend on the unit to which they are assigned or attached for supply, food, health, religious, finance, communication-equipment-repair, legal, and administrative services.

FIRE-FIGHTING HQ TEAM (LA)

3-2. The LA team is assigned to theater Army, corps, or division and exercises operational command over all fire-fighting teams assigned to its AO. An LA team's capabilities include—

- Planning fire-fighting programs for a TO.
- Supervising rescue and fire-fighting operations during aircraft crash incidents, structural fires, vehicle emergencies, natural-cover fires, and emergency response during HAZMAT incidents.
- Planning and conducting fire-prevention operations, HAZMAT emergencies, and initial fire-ground investigations.
- Coordinating resupply of fire-fighting assets, agents, SCBA, and fuel.
- Coordinating mutual aid with other services and HN fire-protection assets.
- Providing maintenance support for technical fire-fighting equipment (MACI fire truck).

WARTIME FIRE-FIGHTING TASKS

DETERMINING MANNING REQUIREMENTS

3-3. An LA team must determine the minimum manning requirements for a continuous 24-hour operations. It must consider sleep schedules, messing, maintenance, and priority mission times. Continuous-operations factors must be added in as a mission's time increases.

ASSIGNING SHIFTS

3-4. Crews must be assigned for duty according to mission needs and threat updates. An LA team will determine the priority requirements and the standby and alert schedules for the assigned crews. Schedules will be posted in the fire communications center (FCC).

INVENTORYING EQUIPMENT AND SUPPLIES

3-5. An LA team maintains the current status of the equipment and fire-fighting supplies for continuous operations and resupply after the missions. It also recharges the SCBA and fire-fighting agents. The team must identify missing equipment and shortages of fire-fighting supplies to continue or limit operations. Status boards will be located and maintained in the FCC.

ACQUIRING THE COMMANDER'S PRIORITY LIST

3-6. Fire-fighting units will not be able to fight all fires in a combat area. A commander must determine which facilities and equipment have the highest priority regarding life safety and mission accomplishment. Once he develops this list, he must initiate changes as the mission requirements change. An LA team will use this list to assign minimum manning requirements, equipment placement, priority training, prefire plans, and fire-response plans. This list will be posted in the FCC and updated regularly.

MAKING A FIRE-FIGHTING PLAN

3-7. An LA team will develop a fire-fighting plan by using the commander's list, resource information, prefire plans, and experience. The plan will include fire-prevention initiatives, response guidance, and resource management for an overall fire-protection program.

SELECTING DISPERSAL SITES

3-8. An LA team must disperse the fire-fighting assets to protect fire-fighting equipment, agents, and personnel from being destroyed at one time. It should not split the fire-fighting teams to the point where they can no longer effectively accomplish their missions, nor should it place the teams directly at high-priority targets. Sites will be plotted on an AO's map that is located in the FCC.

DETERMINING RADIO STATUS AND CALL SIGNS

3-9. An LA team determines the radio disciplines and call signs for the fire-fighting teams on the operational radio network.

LOCATING VEHICLE MAINTENANCE PERSONNEL AND ASSETS

3-10. An LA team locates the maintenance-support and vehicle-recovery channels.

INITIATING AN FCC

3-11. The senior fire official (SFO) will set up an FCC for reporting emergencies, initiating responses, assigning crews, maintaining logbooks, and overseeing the normal and emergency operations of the fire-fighting teams. He will receive and record reports on fire damage; injuries; unexploded ordnance (UXO); and nuclear, biological, chemical (NBC) agents from fire crews and send these reports to a higher level.

DEVELOPING MUTUAL-AID AGREEMENTS

3-12. An LA team should develop plans with the other services' fire-fighting assets. It should define the required assistance and request procedures for assistance, limitations of assistance, and security considerations. If HNS is

available, the team should develop a plan with the senior authority controlling those assets.

LOCATING FIRE-FIGHTING ASSETS AND ESTABLISHING RESUPPLY CHANNELS

3-13. A resupply of fire-fighting agents within an AO may be hard to find. An LA team must make establishing the resupply channel for more fire-fighting agents for sustained operations a priority.

INITIATING THE REQUIRED TRAINING PROGRAM

3-14. Wartime operations will require training on mission-unique equipment and facilities to ensure maximum effectiveness of fire resources. An LA team should initiate training as soon as a commander establishes his priority list and the team can accomplish prefire planning. Response routes, crew assignments, and attack strategies are all part of the training.

CONDUCTING FIRE-PREVENTION INSPECTIONS OF FACILITIES

3-15. An LA team must inspect the facilities occupied by US forces to ensure the safety of personnel and equipment. It will inspect the buildings equipped with a fire-protection system, ensuring proper operation and serviceability.

ENSURING THAT PROTECTIVE MEASURES ARE TAKEN TO PROTECT PERSONNEL AND EQUIPMENT

3-16. An LA team must ensure that—

- The equipment is protected by a hardened position, when possible.
- The personal protective positions are built in the immediate area of the fire-fighting vehicle's position to ensure a quick response to an emergency. These positions should provide protection from direct small-arms fire and from overhead artillery.
- All personnel use camouflage materials and netting properly.

PREPARING A RESPONSE CHART

3-17. An LA team will develop a fire-response chart detailing the response routes (primary and alternate), crew and equipment assignments by targets, and backup assignments. This response plan must be updated as a commander's priorities and missions change. The team will assign fire-fighting missions according to the commander's priority list of mission-essential assets. This chart will be located in the FCC for dispatchers to use.

FIRE-FIGHTING TEAMS (LB AND LC)

3-18. These teams perform the operational task of fire fighting within their AO. The senior fire-fighting personnel assigned to an LB or LC team that deploys without a HQ team will be responsible for that team. If several teams are assigned together, the senior firefighter will take charge of the teams and perform the functions of the HQ team.

3-19. The LB (table[s] of organization and equipment [TOE] 05510LB00) and LC (TOE 05510LC00) teams depend on the HQ fire-fighting team (TOE 05510LA00) for C^2 and maintenance of the MACI fire truck. When that support is not available, the senior firefighter assumes the C^2 responsibility.

Assigned to theater Army, corps, or divisions, the LB and LC teams are allocated as follows: one per air-traffic service company and one per headquarters and headquarters company (HHC) of the CSG; two per petroleum supply company and two per petroleum-pipeline and terminal-operating company. The teams—

- Provide 24 hours of fire protection and personnel rescue and administer first aid.
- Implement a fire-protection program for the logistics-storage area (LSA), intermediate-support base (ISB), forward operating base (FOB), and aviation and major facilities. Such facilities include but are not limited to petroleum tank farms, petroleum-distribution sites, open and closed warehouse facilities or general warehouses, and enemy prisoner of war (EPW) and civilian-internee camps.
- Fight aviation fires and extricate personnel and equipment from crashed aircraft.
- Provide fire-fighting protection against grass or brush fires within their assigned area of responsibility when augmented with combat or construction engineer soldiers.
- Provide 6,000 gallons of water, per trip, to support the MACI fire truck.

3-20. An LC team will identify all bodies of water that may be used to combat a fire or resupply empty fire-fighting vehicles. It will then develop a plan that identifies the locations and the equipment needed to use these water sources. The sources should be within a camp's perimeter or within a 2-mile radius of a camp. Sources will be plotted on an AO's map that is located in the FCC.

Chapter 4

Wartime Operations

4-1. During wartime and contingency operations, Army engineer fire-fighting forces are assigned or attached to a CSG/an ASG of a theater Army area command (TAACOM) and must protect personnel, aircraft, facilities, materials, and equipment from fire. Extensive facility, utility, and runway and taxiway damage may occur. Under these circumstances, a commander will face many critical emergency situations. Fire departments will be required to provide fire-fighting, as well as other mission-support, requirements. Commanders at all levels employ the resources to *move and fight*. To this end, fire-protection resources protect critical components needed for sortie generation, such as facilities and aircraft. This chapter provides general guidance for planning, training, and developing wartime and contingency-operations policies, which must be adapted to threat, mission, and location by planners at all levels.

FIRE-PROTECTION WARTIME MISSION, LIMITING FACTORS, AND ASSUMPTIONS

4-2. To maintain fire-protection capabilities, risks to fire-protection personnel, vehicles, materials, and equipment must be minimized. The rules for wartime fire-protection operations differ radically from peacetime procedures. The presence of battle damage, chemical agents, munitions, and submunitions will complicate fire-fighting and rescue operations.

FIRE-PROTECTION WARTIME MISSION

4-3. The preattack fire-protection mission is to—

- Eliminate or reduce the fire threat to personnel, aircraft, and facilities before an attack.
- Protect fire-protection resources during an attack.
- Provide postattack suppression and rescue response to fire incidents that seriously jeopardize an AO's combat-generation capability.

LIMITING FACTORS

4-4. Firefighters will probably encounter several critical problems during a wartime environment. These conditions should be expected as the norm rather than as the exception.

- The lack of adequate chemical-warfare-defense equipment (CWDE) can make fire-protection capabilities minimal to nonexistent under chemical conditions. With existing CWDE, firefighters are severely limited during fire-fighting and rescue operations. The equipment does not provide heat shielding, and firefighters cannot approach intense exterior or interior fires. Due to inadequate respiratory

protection, firefighters cannot attack interior fires (aircraft and structures). Fire fighting can be attempted from a distance, but with limited effectiveness and wasted agents. When using CWDE, firefighters should not attempt fire fighting and rescue unless there is a reasonable probability of successful life-saving efforts or preserving mission-critical assets without injury or death to themselves.

- The lack of an adequate water supply will severely limit fire-fighting and rescue operations.
- All fire vehicles are unarmored and susceptible to major damage during attacks.
- The firefighters will be unable to extinguish all large, totally involved fires, such as large-frame aircraft and POL tanks. Attempts to extinguish such fires will result in unwise depletion of available resources due to personnel, agent, and vehicle limitations.
- Extreme climatic conditions and the use of protective equipment will limit performance.
- Fire-protection resources will be at risk until hardening measures are effected.
- A six-person firefighter team (LB) is capable of providing only one 12-hour shift in support of strategic, wide-body aircraft operations. The team must be augmented by another six-person team to complete a 24-hour operation.

ASSUMPTIONS

4-5. Fire-fighting vehicles and equipment should be available for the initial phase of a contingency or wartime operation. Vehicle, equipment, and manpower shortfalls must be identified to the supporting agency. Shortfalls take time to correct. The priority should be on assets that directly affect capabilities. Because there will not be enough firefighters to respond to all emergencies, other services’ or HN fire-fighting assets should be used to the maximum extent possible. Military firefighters will probably face more fires in combat situations than they will be able to extinguish. An AO commander, with input from an available SFO, will determine a priority of effort. With the likelihood of these assumptions being real, firefighters must expect the following:

- The effectiveness of fire-protection personnel will be diminished by physical and psychological stresses because of sustained emergency-response operations and attrition of fire-fighting personnel.
- Main operating bases (MOBs) will have adequate in-place, fire-protection resources to provide needed protection during sudden conflict. These resources include a trained and capable fire-fighting and rescue force and enough fire-fighting equipment and vehicles and chemical-protection equipment so that firefighters can survive a chemical attack.
- Adequate fire-protection resources will be available before an attack at MOBs, FOBs, and bare bases (BBs).

- Enemy attacks might include chemical-warfare (CW) agents.
- A reattack could occur.
- Water-distribution system(s) will be damaged during an attack and will not be totally usable for fire-fighting purposes.
- Fire-department responses will be delayed by UXO and craters or debris in roads, taxiways, and runways. Firefighters will have to perform explosive-ordinance reconnaissance (EOR), which will result in a delayed arrival. When UXO is present, alternate routes will be required.
- Some fires might progress past the incipient stage, cause major damage, and necessitate greater depletion of extinguishing agents because of response delays warranted by EOR.
- The fire department will not have the resources to attack and extinguish all structural fires, respond to all rescue situations, and support all aircraft incidents simultaneously.
- Hostile activities may deplete fire-department resources (personnel, vehicles, and equipment), unless physical protection is provided.

PREATTACK

4-6. A preattack occurs between the time a threat is detected and an actual attack occurs on a base. The preattack period is a transitional period from peacetime to a wartime mode of operation. This phase may begin months before actual hostilities occur; it will not be less than 20 days. However, a transition may be required at any time when in a threat area. Preparation is critical to a rapid transition and will include three distinct efforts: planning, training, and acting. Based on the projected postattack environment, the following minimum needs can be expected:

- Critical fire-department-support resources such as war-readiness spares kits (WRSK), war-consumable-distribution-objective (WCDO) levels, vehicle maintenance, food service, and personnel shelters must be protected.
- Specific fire-suppression-and-rescue responses must be accomplished based on their priority in relation to the start of an operation.
- Ignition and fuel sources must be removed from facilities to reduce the possibility of responding to a postattack fire and to reduce the rescue workload.
- Facility occupants (especially those in critical facilities) must be trained in first-aid fire fighting so that they can extinguish or contain fires in their incipient stage.

FIRE-PROTECTION SYSTEM

4-7. Fire protection consists of many interdependent elements that contribute to the survivability and operability of the fire-fighting force. These elements include—

- Expedient splinter protection and physical protection.
- Crash and structural rescue, C^2, and support vehicles.
- A sufficient number of trained and capable firefighters.
- Ancillary equipment, which includes proximity suits, SCBA, recharging apparatus for SCBA, CWDE, mobility gear, and weapons.
- Consumable materials such as water, foam (Classes A and B), and breathing air.
- Base stations and mobile and portable units for communications.
- Essential support regarding vehicle maintenance/spares, fuel, food service, and medical resupply, facilities, and utilities.
- Adequate training in general military and contingency skills, priorities, tactics, strategies, and procedures.

PLANNING

4-8. Planning is the key to successful transition. A comprehensive understanding of what is expected can be obtained through planning documents which are prepared by a variety of agencies at all command levels. Preferably, plans developed before a preattack will normally be available for MOBs. However, plans may not be available which address specific forward operating locations that may become operational. In this event, planning will have to be accomplished immediately after arrival. As a minimum, fire-fighting teams must initiate the plans and actions. They should use plans that the major Army command (MACOM), local base operations, and fire-protection organizations develop, when available. Fire-fighting teams must—

- Survey water supplies for use during postattack, including both on-base and off-base sources (swimming pools, cooling towers, reservoirs, tankers, pumps, wells, storage bladders, supply points, and Harvest Eagle/Falcon mobile water-distribution systems).
- Construct expedient access routes to auxiliary water, as necessary.
- Establish a supply of pumps, hoses, and equipment for rapidly replenishing water where hydrants are not available.
- Consider installing dry hydrants near lakes, streams, and rivers to facilitate drafting.
- Survey the base terrain for naturally protected areas for fire vehicles, agents, equipment, and personnel. Using natural features (ditches, hillsides, and trenches), combined with camouflage netting, provides effective concealment.

- Identify locations, if required, where expedient construction could be used to provide splinter protection for fire vehicles, agents, and personnel.
- Determine how many sandbags they need to construct expedient protective facilities. Earth berms or bermed revetments are effective and are rapidly constructed.
- Coordinate with POL personnel to ensure that POL areas have drainage ditches and holding areas to prevent spilled fuel from endangering other tanks.
- Survey possible fuel-holding or tank-drainage diversion areas where spilled fuel could burn without endangering other critical fuel supplies.
- Identify all *safe* areas where munitions are not expected to impact, and disperse assets (fuel and spare parts and fire-fighting agents) into these areas.
- Identify the need for camouflage netting and concertina wire to aid in concealment and security.
- Inventory all agents and other critical equipment and supplies. If shortages exist, they must submit high-priority requests for additional agents and equipment that they may need. The teams should try to obtain stocks from local sources.
- Establish fire-fighting procedures for a CW environment.
- Review a facility's priority listing. A facility's priority system must identify those facilities most critical to sortie generation. In a multiple-fire operation, fire-fighting and rescue response must be made on a priority basis based on a commander's assessment and the amount of fire-fighting equipment available.
- Coordinate with vehicle maintenance for the expedient and priority repair of fire vehicles.
- Ensure that vehicle spare parts, including tires, are available and protected. Mechanics should be dedicated to fire-vehicle maintenance, and special levels should be established for spare parts.
- Establish duty hours and crew-change procedures.
- Determine where firefighters will be housed and establish feeding procedures, rest periods, relief procedures, and processing areas. Firefighters should be located as close to their dispersed location as possible.
- Coordinate with the MACOM and local HN fire officials for support.
- Pre-position fire hoses, nozzles, and equipment at critical, mission-essential facilities for first-aid fire fighting by occupants.
- Provide training in the use of fire-fighting equipment, when required.
- Plan dispersal and physical protection.

- Locate dedicated, splinter-protected areas for fire vehicles, agents, and personnel. These areas include the following:
  - — Hardened aircraft shelters.
  - — Earth-bermed modular revetments.
  - — Earth berms, trenches, or bermed trenches.

TRAINING

4-9. Intense training is required after arriving at a base of operations. Training firefighters to adapt to a wartime operation is essential for survival. Training base occupants on fire-protection responsibilities and providing necessary refresher training are necessary for protecting a base's resources. Other training considerations are listed below:

- Conducting *fine-tuning* training for fire crews, including *what-if* situations, attrition of vehicles, and personnel and materials situations.
- Training in procedures required to conduct fire fighting and rescue in a CW environment, based on the type of equipment available. While wearing CW defense ensemble, close-in fire fighting should not be attempted except to save lives or mission-critical assets. There must be reasonable probability of success without undue danger to firefighters before any fire fighting or rescue is attempted.
- Training fire-protection personnel in the tactics and strategy that they will use during fire-fighting operations in a postattack environment, to include contamination avoidance.
- Conducting refresher training related to survival, such as EOR; CW defense; convoy security; defensive combat skills; base denial; camouflage, concealment, and deception (CCD); and hardening.
- Establishing cooperation with the HN, to include joint operations, C^2, mutual training on fire-fighting equipment, and aircraft fire-fighting and rescue procedures on host and US mission aircraft.
- Conducting refresher, first-aid firefighter training for personnel whose duty locations are in critical facilities. Occupants must know what to do in case of a fire; how to use available fire extinguishers, standpipes, and installed systems; and what the risks and limitations are in such operations.

CRITICAL ACTIONS

4-10. Fire-protection personnel must perform certain critical actions before a conflict to ensure that fire-fighting and rescue capabilities survive. They must—

- Don chemical-protective equipment if they might be exposed to a CW environment. They do this according to the mission-oriented protective-posture (MOPP) level that a commander determines. In a surprise attack, fire-protection personnel must don a complete CW ensemble immediately.

- Affix M8 paper and M9 tape to the exterior of each fire-fighting vehicle and fire-station facility.
- Disperse personnel, vehicles, equipment, and agents to protected areas. Agent dispersal should include both fire-department stock and special levels. Fire-protection personnel must record the amounts and location of all dispersed equipment and materials. They must disperse and locate agents in the same splinter-protected areas as the fire vehicles.
- Locate agents in at least two separate areas.
- Handle fire-fighting vehicles as follows:
  - — Conceal vehicles with natural cover, when possible.
  - — Place no more than one vehicle in one location.
  - — Position one vehicle to observe runways and aircraft parking areas, when possible.
  - — Keep vehicles at least 300 feet away from priority 1 buildings, aircraft, and other likely targets.
  - — Place vehicles in a staggered line so that all will not be destroyed with one pass of an enemy aircraft.
- Ensure that dispersed vehicles have first-aid kits, fresh water, and full fuel and agent tanks.
- Locate and disperse all vehicle spare parts and tires, WRSK, and other critical materials to splinter-protected areas.
- Use expedient construction, to include providing splinter protection and concealment for agents that cannot be moved.
- Provide splinter protection and concealment for the FCC, the fire/crash radio-network base station, and the repeater units.
- Consider a line-of-sight (LOS) requirement between radios and repeater units.
- Provide splinter protection and concealment for fire-vehicle fuel supplies. Equip the tanks with hand pumps or other measures.
- Ensure that POL dikes are intact.
- Ensure that utilities and POL piping systems are isolated.

TRANSATTACK

4-11. A transattack begins with the first enemy action at a base and ends when the base transitions to a recovery role and begins usual operations. During a transattack, fire-department personnel will be dispersed throughout a base so that they can observe and report the airfield-attack status. If possible, they must note information (the number and type of aircraft attacking a base, an attack's intensity, base areas receiving the most damage, and fire starts) for later relay to the FCC. Firefighters should be able to make general observations about the type of attack in progress (air attack with

various types of conventional weapons, land attack with mortars or small arms, CWs attack, and so forth) and an attack's duration. Observation and reporting are incidental to the primary purpose of surviving and must not put firefighters at risk. A runner or a secure voice radio should relay the information once an attack is over.

4-12. All personnel must be protected with appropriate equipment, according to the threat. These measures may have been inhibited during preattack actions if advance attack warning was available. However, firefighters must be prepared to cease operations instantly and don their protective equipment in case of a surprise attack. During an attack, survival takes priority over all other activities, including fire fighting and rescue.

4-13. Fire-protection vehicles and personnel should remain dispersed and protected during an attack and a reattack. They should not perform fire-fighting or rescue operations except immediate-area buddy-care activities. Fire-protection personnel should not take cover—

- Inside or beneath a fire vehicle unless it is located in a protected dispersal location.
- Within 300 feet of priority 1 facilities, except for fire stations.
- Within 500 feet of aircraft.
- Within 1,000 feet of POL- or munitions-storage areas.

POSTATTACK

4-14. The postattack time period immediately follows an attack on a base. A base is vulnerable to air, ground, and combined air and ground attacks, with a variety of ordnance. Fire-department operations in the postattack environment are critical to base operations and to generating combat sorties as soon as possible.

TRANSITION TO BASE OPERABILITY (BO)

4-15. SFOs must constantly be aware of the need to recover combat capabilities. Transitioning to BO must begin immediately following an attack. As BO progresses through the various phases, significant attrition of firefighters, equipment, and agents can be expected. Fire-protection personnel should be trained for their involvement in the preattack, transattack, postattack, and reattack phases of BO. MACOMs and commanders at all levels should supplement this concept with guidance that is applicable to their missions and TOs. BO plans should provide a smooth transition to recovery operations following an attack. They should address the transition to BO in environments where communications are intact, interrupted, or totally destroyed.

LOCATION OF A FIRE CHIEF

4-16. A fire chief should be located where communications facilities are available to control fire-protection resources and where physical security is in place. A fire chief directs allocating the fire-fighting resources in concert with command priorities and concurrent BO and base-recovery operations. A chain

of command is normally established locally, with a fire chief normally reporting to a base commander.

CONSIDERATIONS

4-17. After an attack, existing base roadways and taxiways may be impassable because of denial munitions, bomb craters, wreckage, and other debris. Therefore, fire vehicles may have to operate fully loaded off hard surfaces or in sand, snow, mud, rocky soil, or boggy areas. Such conditions will make submunition detection more difficult; therefore, fire crews must be careful to avoid rendering fire vehicles incapable of supporting BO.

4-18. Firefighters will be faced with numerous fires, extensive damage, and injured personnel who require emergency rescue and life-saving care. Deploying to fire-fighting and rescue locations may be complicated by UXO, craters, pavement damage, and facility debris. Fire-fighting and rescue operations may have to be accomplished with limited numbers of people, equipment, and materials. Attrition will decrease the availability of firefighters, fire vehicles, and agent levels. Commanders, in concert with fire chiefs, must decide which fires to fight and which to let burn and which people to rescue and which to leave to buddy care. General considerations during a conventional attack are discussed in the following paragraphs:

Fire Spread

4-19. Fire spread within an aircraft-shelter complex is unlikely because of the distance where hardened shelters are available. Fire spread from one munitions storage facility to another is unlikely because of the distance between facilities when concrete, igloo, or earth-covered construction is used. However, fire spread of more than one storage igloo could occur if stored munitions are detonated. When facilities are not available (such as in BB operations), greater separation and expedient earth-berming are needed to prevent fire spread.

4-20. Fire spread from one base structure to another in the containment areas is possible, although less probable than in World War II. Modern facilities do not have the surface density of wood to support sustained fire spread or fire storms. When temporary construction (using wood) is used, fire spread is possible unless facilities are properly separated. For tent cities, training occupants about proper fire procedures could limit fires to one tent.

4-21. When POL tanks are ignited, unburned fuel should be pumped or drained from the tanks if the distribution system remains relatively intact and if a receiver for the fuel is available. Such action will reduce extinguishment time and result in a shorter burn time, if the tanks are allowed to burn until self-extinguishment occurs. Draining the tanks away from other storage tanks can reduce the risk of fire spread. Bladder tanks are less of a problem. They are located at ground level and are normally bermed to contain any spill. If properly planned, they should be separated sufficiently to prevent fire spread. If they are not, fire spread on open ramps with multiple aircraft could occur.

Damaged Facility Fires

4-22. Success in stopping fire spread depends on the available number of vehicles and personnel and their capabilities and how rapidly firefighters engage the fires. Fire fighting is impractical when burning buildings are exposed to neighboring fires from which the heat is intense enough to sustain the fire and reignite the building. When fires have spread through a major portion of a building (including the spaces between the walls), the structure will probably burn completely and cease to be a further fire threat in less time than it would take to extinguish the fire.

4-23. Blast-damage structures can be expected to burn in one-third to one-half the time required for undamaged structures. If a significant loss of compartment integrity occurs (damage to interior walls), a fire will spread faster than it would have in an undamaged structure. Blast damage will change a fire's environment and provide easy routes for fire spread to adjacent compartments. Fire spread in damaged buildings will be rapid and simultaneous, in all directions, with large flame areas. The intensity of a fire and the need for fire suppression will be lessened by keeping a fire from penetrating into concealed spaces.

4-24. Occupants of mission-essential critical facilities must be aggressive in first-aid fire fighting as fire-department response may be delayed. Peacetime workplace-safety training prepares occupants for this task.

Vehicle Operability

4-25. During BO operations, fire vehicles must be maintained and repaired as quickly as possible. Repairs should mainly consist of removing and replacing components rather than lengthy troubleshooting and repairs. Repairing components should occur only when time permits and vehicle downtime cannot be improved by replacement. Major components or subsystems expected to fail must be identified, stocked, and protected at all MOBs. Spare parts to support collocated operating bases (COBs) and BBs normally come from MOBs.

Explosive Ordnance Reconnaissance

4-26. Explosive-ordnance-disposal (EOD) personnel will not be available immediately to clear response routes from a dispersed location to fire and rescue sites. The level of EOR training provided in peacetime prepares firefighters to recognize ordnances. Therefore, firefighters must perform EOR during response.

Decontamination

4-27. If contamination occurs, decontamination must take place. However, do not decontaminate when it will cause a delay in response to critical fire-fighting and rescue operations. Firefighters must remain fully protected with the appropriate CW defense ensemble before starting decontamination procedures.

4-28. Fire-fighting resources may be needed for personnel and large-area decontamination under extreme conditions. However, depleting fire-fighting resources must be considered. They should be used only when all other sources have been exhausted.

Contamination Avoidance

4-29. If attacks include CWs, firefighters must—

- Avoid driving or walking through suspected chemical-agent puddles, mists, and so forth.
- Stay under a shelter, when possible.
- Avoid leaving their vehicle during operations except to conduct a rescue or take cover during MOPP level 4.
- Approach fires from upwind.
- Identify and isolate contaminated areas, if possible.
- Avoid dispersing chemical-agent puddles, mists, and so forth.

4-30. These measures, at a minimum, will reduce unnecessary and lengthy decontamination procedures and allow quicker recovery after an attack.

FIRE-DEPARTMENT OPERATION PROCEDURES

4-31. Fire-department personnel will immediately assess and report damages in their vicinity, including the presence or lack of chemicals, submunitions, and other UXO. At the conclusion of an attack, fire crews will immediately report the status of personnel, agents, and vehicles. War plans must address accomplishing this task with both normal and interrupted or nonexistent radio communications.

4-32. A fire chief directs fire vehicles to fire-fighting or rescue operations and provides on-scene C^2. He provides the base-defense operations-center (BDOC) staff with a situation assessment regarding structural and aircraft fires; UXO risks; vehicle, personnel, and agent status and attrition; water and agent availability; the presence or lack of chemicals; and pavement damage. A fire chief receives directions from a BDOC or commander and advises the commander on whether or not to commit fire equipment. He will then employ fire-fighting forces, as directed. If communications are out or fail, the senior fire-protection person available at the scene will direct employing the fire-protection resources based on information provided during preattack training. However, he should not employ fire-fighting resources to save totally involved aircraft or POL and other facilities. Such operations only deplete fire-fighting resources.

4-33. Employing fire-department assets will be based on the relative value of the response to sortie generation. Forces must be employed according to the priority listing, which is aircraft and aircraft-support facilities. Given a choice, a fire chief should respond to a critical aircraft-maintenance facility rather than a single burning aircraft.

4-34. During a response, firefighters must proceed with extreme caution from dispersed areas because of UXO. If UXO makes travel by one route impossible, they must take alternate routes. The objective is to take the shortest possible route with minimum UXO exposures.

4-35. To ensure that fire-department resources are expanded for maximum support of sortie generation, the commander will direct firefighters when to

carry out non-fire-related operations. After each attack, the priority list should be revised and distributed to all concerned.

REATTACK

4-36. After receiving a reattack notice, firefighters will cease all fire-fighting actions and take cover. With no protection for fire-department assets, aircraft, facilities, and lives could be lost. This doctrine must be clearly stated and understood at all levels of command. If time, distance, and UXO do not allow the return to splinter protection, crews should take advantage of the nearest available cover and wait out an attack. During a reattack, firefighters should make observations and complete the reports that were discussed earlier. They must make these observations, however, without risk of injury. At the end of a reattack, recovery actions are the same as discussed earlier except for previously safe routes and a facility-priority list.

VEHICLE AND MANPOWER CALCULATION

4-37. Tables 4-1 and 4-2 are from Department of Defense Instruction (DODI) 6055.6. They list the minimum number of fire trucks that are required to support aircraft which are used during stability operations, support operations, and regional conflicts. Tables 4-3 through 4-5, pages 4-13 and 4-14, describe the individual TOE fire-fighting-unit authorizations for manpower and equipment.

Table 4-1. Classification of common military and civilian aircraft

Group 1: Small-Frame Aircraft (less than 4,000 gallons)	Group 2: Medium-Frame Aircraft (4,001 to 15,000 gallons)	Group 3: Large-Frame Aircraft (15,001 or more gallons)
A-7, A-10, A-37, AH-1G, AH-46	B-72, B-737	B-1, B-2, B-52, B-707, B-720, B-747
C-7, C-12, C-26, C-23A, C-131, C-140, CH-47, CH-54	C-9, C-20, C-130	
	DC-9	C-5, C-135, C-137, C-141
DC-8	F-111, FB-111	DC-10
F-4, F-15, F-16, F-27, F-117, FH-227	L-188	E3-A, E-4
HH-1H, HH-53, HU-16		KC-10
O-2, OH-6, OH-58, OV-1, OV-10		L-1011
T-37, T-41, T-42, T-43, TA-55, TR-1		
U-1, U-3, U-4, U-6, U-8, U-9, U-10, U-17, U-21, UH-1, UH-21, UH-60A		
WU-2		
NOTE: Aircraft groupings are categorized by aircraft fuel load, to include tip and drop-off tanks.		

Table 4-2. DOD minimum aircraft rescue fire-fighting vehicle allowances

Airfields Operating Description	Vehicle Allowance
Permanently assigned aircraft having less than 1,000-gallon fuel capacity and all helicopters	To be determined by DOD component
Permanently assigned aircraft, less than 75 feet in length or carrying ordnance	Two, with 2,000-gallon total capacity
Permanently assigned aircraft, less than 100 feet in length or carrying ordnance	Three, with 3,000-gallon total capacity
Permanently assigned aircraft, less than 175 feet in length: ordnance, hazardous, or high-value cargo	Three, with 9,000-gallon total capacity
Permanently assigned aircraft, greater than 175 feet in length: ordnance, hazardous, or high-value cargo	Four, with 12,000-gallon total capacity
NOTE: These minimum allowances do not include specialized ARFF vehicle requirements for airfields, such as twin agent units, rescue vehicles, and rapid intervention vehicles.	

Table 4-3. Engineer fire-fighting HQ team (TOE 05-510LA00)

Personnel			
Job Title	**MOS**	**Rank**	**Quantity**
Fire marshal/detachment commander	21B00	1LT	1
Fire inspector	51M30	SSG	1
Fire-team chief	51M30	SSG	1
Administrative clerk	71L10	PFC	1
		Total	**4**

Equipment		
Line Number	**Description**	**Quantity**
C68719	Cable telephone: WD-1/TT DR-8, 1/2 kilometer	1
C74517	Compressor unit RCP: air, 5 hp, gas- and diesel-driven, 5.1 cfm, 3,200 psi	1
H88468	Forced-entry-and-rescue equipment set: aircraft crash	1
J71543	Installation kit: MK-2147/VRC F/KY-57 W/AN/VRC-43 or AN/VRC-46	1
J88275	Installation kit, electronic equipment: MK-2418/VRC F/AN/VRC-46/64 or AN/GRC-160	1
M11895	Mask, CBR: protective field	4
Q20935	Radiacmeter: IM-93/UD	2
Q56783	Radio set: AN/VRC-64	1
R59160	Reeling-machine cable hand: RL-39	1
R72484	Repair and refilling kit: hose repair and dioxide fire extinguisher	1
R94977	Rifle, 5.56 millimeters: M16A1	4
T05028	Truck, utility: tactical, 3/4 ton, W/E M1009	1
T59482	Truck, Cargo: tactical, 5/4 ton, 4 by 4, W/E M1008	1
T62101	Siren, electric, motor operated: bracket mounted, W/D light, weatherproof	2
V31211	Telephone set: TA-312/PT	1

Table 4-4. Engineer fire-fighting fire-truck team (TOE 05-510LB00)

Personnel			
Job Title	**MOS**	**Rank**	**Quantity**
Crash-rescue sergeant	51M20	SGT	1
Crash-rescue specialist	51M10	SPC	2
Fire-truck operator	51M10	PFC	3
		Total	**6**

Equipment		
Line Number	**Description**	**Quantity**
C68719	Cable telephone: WD-1/TT DR-8, 1/2 kilometer	1
E00533	Charger, radiac detector: PP-1578/PD	1
H56391	Fire-fighting equipment set: truck mounted, multipurpose	1
K87338	Installation kit: MK-1454/U F/VRC-53 64 CRC125, 160 inches, not covered by spec kit	1
M11895	Mask, CBR: protective field	6
Q20935	Radiacmeter: IM-93/UD	1
Q56783	Radio set: AN/VRC-64	1
R59160	Reeling-machine cable hand: RL-39	1
R94977	Rifle, 5.56 millimeters: M16A1	6
T59482	Truck, cargo: tactical, 5/4 ton, 4 by 4, W/E M1008	1
T62101	Siren, electric, motor operated: bracket mounted, W/D light, weatherproof	2
V31211	Telephone set: TA-312/PT	2

Table 4-5. Engineer fire-fighting water-truck team (TOE 05-510LC00)

Personnel			
Job Title	**MOS**	**Rank**	**Quantity**
Firefighter crash/rescue specialist	51M10	SPC	1
Firefighter fire-truck operator	51M10	PFC	1
		Total	**2**

Equipment		
Line Number	**Description**	**Quantity**
028318	Distributor, water-tank type: 6,000 gallons, semitrailer mounted (CCE)	1
K87338	Installation kit: MK-1454/U F/VRC-53 64 CRC125, 160 inches, not covered by spec kit	1
M11895	Mask, CBR: protective field	2
Q20935	Radiacmeter: IM-93/UD	1
Q56783	Radio set: AN/VRC-64	1
R94977	Rifle, 5.56 millimeters: M16A1	2
T61171	Truck, tractor: MET 8 by 6, 75,000 GVW, W/W, C/S	1

Chapter 5

Fire-Prevention Operations

5-1. The purpose of fire prevention is to eliminate hazards and elements that cause fires and to eliminate conditions that will contribute to a fire spreading. In a TO, this is more important than ever. In most cases, the available fire-fighting resources will not be adequate to handle the areas of responsibility, which makes preventing fires more important. Effective fire prevention requires establishing well-planned programs. Enforcing the guidelines in these programs can save the effort and expense of extinguishing fires and reduce the loss of life. Fire departments must have command support and cooperation to implement and maintain these programs.

SECTION I. PLANS AND PROCEDURES

5-2. To enhance the effectiveness of fire inspections and assistance to a community, fire-department personnel must be well-versed in the organizational structure of their fire department and the roles and responsibilities of each section. An integral source in a fire-inspection process is prefire plans. These plans provide fire personnel relevant information about a structure or an aircraft that may be involved in a fire. The information could significantly enhance the potential success of a fire department's operations. If prefire plans are properly maintained and updated, firefighter safety is increased and firefighters will know about any special hazards or dangers in advance.

FIRE REGULATIONS

5-3. DOD, DA, and local fire-prevention regulations must be available to all fire personnel. An installation's fire marshal prepares local fire regulations. They must define the fire-protection functions for all areas on an installation, such as tenant units, assigned detachments, family housing, and quarters. Local regulations should include the following items:

- A statement on the importance of fire prevention.
- The responsibilities of people in fire prevention. People at all levels on an installation should be included.
- The fire-safety areas, which include the location of fire exits, first-aid stations, and fire extinguishers. Also included should be fire-reporting and -fighting procedures.

- The policies concerning smoking, fire inspections, storage areas, electrical wiring and appliances, static electricity, flammable liquids, flammable compressed gases, explosive atmospheres, and maintenance operations.

PREFIRE PLANS

5-4. Fire departments are organized so that fire personnel can protect life and property from fire. All personnel must study their area to know what problems exist. After analyzing the problems, they can devise prefire plans to handle the problems. Fire-department personnel should consider the following:

- Area one, an installation's layout. This layout includes the streets, roads, and alleys from a fire station to a fire scene; the location of the water supply and the available volume and pressure; and the buildings' exposure.
- Area two, the availability of equipment. This area includes the types of apparatus, vehicles, and mechanical and motorized equipment on an installation.
- Area three, available personnel.

5-5. Prefire plans must be flexible to allow for changes in personnel and equipment availability. The areas to consider are the—

- Location of flammable stores, hazardous-operations areas, and areas that could be a fire's point of origin.
- Location of hydrants and other water sources, with readings of available amounts and pressures.
- Lengths of ladders and the proper placement spots to reach all required areas.
- Horizontal or vertical openings, (hallways, open stairways, shafts, false ceilings, or attics) that would be good ventilation openings.
- Best and most available apparatus for responding to a fire, approaching buildings, conducting hose-laying procedures, and placing water streams.
- Location of the utilities and who shuts them off and how.
- Effects of weather changes on building accessibility and response time.
- Installed fire-protection or -detection systems, including locations and procedures for connecting pumpers to installed extinguishing systems.

AIRCRAFT

5-6. Prefire plans for aircraft crash/rescue operations require more flexibility than prefire plans for structural fires. Because the exact crash location is unknown, only make general plans as to likely crash sites. When developing prefire plans, remember the location, mission, climate, and terrain of your installation.

5-7. Prefire plans should include information on the different types of aircraft handled at an installation. Appendix B details several Army aircraft. The control tower can obtain specific information (number of personnel, amount of fuel, amount and type of ordnance on board, nature of an emergency) at the time of the emergency.

5-8. The weather, terrain, runway conditions, amount of available equipment and remaining fuel, and crash location are some factors that govern placing equipment at an aircraft's crash operation. Prefire plans can only cover general placement procedures and should allow for flexibility, based on the situation. Other factors to consider include an aircraft's landing speed, the wind direction and speed, and an aircraft's stopping distance. Prefire plans should also include provisions for acquiring additional equipment.

MISSILE AND SPACE VEHICLE

5-9. Fire-protection personnel at missile and space-vehicle test or launch sites deal with different hazardous situations. The prefire plans must include procedures for safely storing, handling, and disposing the liquid and solid propellants used in missile engines. Plans should include the—

- Number, type configuration, and operation of missiles or space vehicles and related launch facilities.
- Layout of the launch site, including access roads, terrain, and water supplies.
- Number, type, and location of support facilities.
- Location and configuration of the various propellant storage areas, the nature of the stored materials, and the extinguishing agents which are the safest and most effective for each type of propellant.
- Health hazards that could result from the fuels, oxidizers, other chemicals, and additives to fuels or coolant water. Firefighters may have to wear special protective clothing, reduce or control exposure time, monitor instruments, or perform special procedures.

NATURAL-COVER FIRES

5-10. These fires present different problems for firefighters. Natural-cover fires can cover various-sized areas, involve large numbers of fire-fighting personnel, and require specialized tactics and equipment. Prefire plans are usually limited to information about the type and quantity of available tools and equipment, the people to contact for personnel support, the agencies which can provide assistance, and the current weather information.

PREDISASTER

5-11. Fire-protection personnel usually assist during earthquakes, tornadoes, and floods. Fire-fighting plans should include how to handle disasters and how to safeguard and use the needed equipment, effectively, during a disaster.

SECTION II. WATER SUPPLY

5-12. Water requirements on an installation vary daily. However, the water supply needed for fire fighting must be met at all times. The water supply in sources such as supply lines, wells, and pumps is often not sufficient during high-demand periods. During low-demand periods, water should be stored for use during high-demand periods. Stored water must also be available for emergencies resulting from fires, power failures, breakdown of supply pumps, or accidents. During normal use, stored water must be at or above the level required for fire fighting.

STORAGE

GROUND STORAGE

5-13. Ground storage consists of covered tanks or reservoirs located on the same level as a distribution system. These tanks and reservoirs are more commonly used for receiving tanks, treatment tanks, and limited or special storage. Some installations may have emergency reservoirs. These reservoirs consist of small ground-storage tanks that are supplied by the distribution system but are not permanently connected to the system.

HIGH-LEVEL STORAGE

5-14. High-level storage is the preferred storage method. Where practical, the tanks should be located near the centers of high-water-demand areas to equalize the pressures during periods of peak demand. One high-level-storage method is to elevate standpipes or tanks that are mounted on columns or legs. Another method is to locate one or more ground-storage tanks above the distribution system. These tanks provide a head pressure similar to that of a normal hydraulic grade line.

REQUIREMENTS

5-15. A water-supply system supplies water for domestic, industrial, and fire-protection demands. Domestic demands include functions such as drinking, cooking, bathing, laundering, and watering cultivated areas. Industrial demands include requirements for areas such as central and local heating and cooling equipment and engineering shops. Fire-protection demands include water requirements for hose-line operations and for installed devices such as sprinklers, standpipes, and deluge systems.

5-16. The most important factors that govern a water-supply system are the reliability and capacity of the source, the distribution system, and the storage facilities. A fire inspector must know of any deficiencies in a water-supply system to cope with the available water supply during fire operations. A fire inspector may be asked to appraise a water-supply system at an installation. He should investigate the—

- Amount of stored water that is needed to meet an installation's requirements.
- Type of water storage that is best suited for an installation.

- Provisions for emergency supply and distribution of water.
- Type and size of a normal distribution system.
- Spacing requirements for fire hydrants in all locations.
- Amount of water that is available for fire-fighting operations at all locations on an installation.

WATER

5-17. When practical, an installation's primary water supply should be acquired from a nearby municipality or private water company. When that is not practical, the water supply may come from wells, canals, streams, rivers, lakes, or ponds, depending on an installation's location. The primary supply should include a pressure source in the system. The water supply should originate from two independent sources to ensure water availability if one system fails.

5-18. When a supply source is groundwater, the fluctuation of the groundwater table must be considered. When a supply source is from nearby municipalities, a fire inspector must ensure that the water-supply system is ample and dependable. When a water source is wells, at least two wells should be used. At a minimum, twice as much water should be available as is consumed during an average day. Under these conditions, standby pumping units that have power sources independent of a main system should be available.

DISTRIBUTION SYSTEMS

5-19. The network of mains (feeder and distributors) and fire hydrants that make up the distribution system are laid out as either a grid or a nongrid system. In a large water-distribution system, the mains are classified as—

- Primary feeders, which are large pipes widely spaced to feed the smaller pipes.
- Secondary feeders, which are medium-sized pipes that help supply water at specific locations.
- Distributors, which are small mains that feed individual fire hydrants and other outlets.

Grid System

5-20. This system is laid out in the form of a grid iron. The piping is interconnected from several directions. The pipes are arranged in loops and are supplied from two or more sides. This system works best because hydrants and other connections are fed from many directions, which will increase water delivery. A full grid system does not have dead-end mains.

Nongrid System

5-21. This system is a one-directional flow system. Water flows from a large primary main to smaller feeders. Generally, all feeders result in dead ends. Some negative features of a nongrid system are an increase in friction loss, a quick loss of pressure due to one-directional flow, an operation from dead-end feeders, and increased deposits and foreign matter in all the piping.

FIRE HYDRANTS

5-22. A dry-barrel-type hydrant (Figure 5-1) is used in areas that are subjected to freezing temperatures. A valve is located below the freeze line and is opened with the pressure or against the pressure. After it has been opened and closed, any remaining water in a closed dry-barrel hydrant will drain through a valve at the bottom of the hydrant.

5-23. A wet-barrel-type hydrant (Figure 5-1) is used in areas where temperatures are milder. This hydrant has either a compression-type valve at each outlet or one valve located in the bonnet to control the water flow to all outlets.

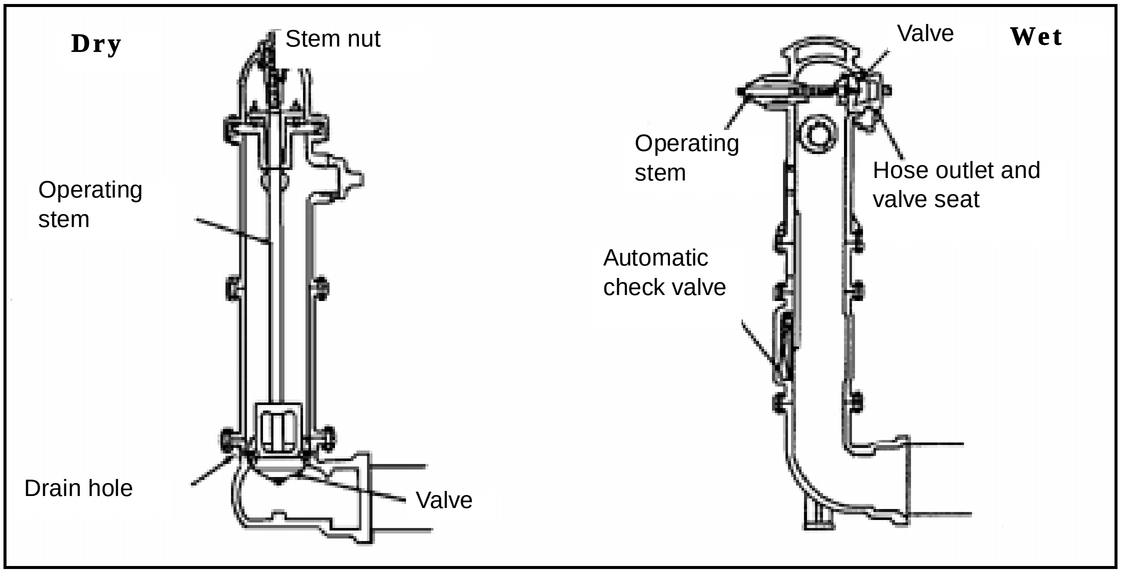


Figure 5-1. Fire Hydrants

LOCATION AND SPACING

5-24. In housing areas, the hydrants should be about 400 feet apart and placed so that two hydrants can reach every building. Firefighters should use no more than 300 feet of hose line. In warehouse and hanger areas, the hydrants should be about 300 feet apart. About 18 inches should be between the lowest hydrant outlet and grade (ground), and not more than 4 feet should be between the operating nut and grade. The principal opening (4 1/2 inches) should face the nearest road or approach. Hydrants that cannot be located away from traffic (loading dock or warehouse areas) should be protected with sturdy barriers designed to prevent damage to a hydrant without obstructing its use.

FLOW TEST

5-25. A flow test measures the pressure of a hydrant's system. A small main may have only two hydrants, which should provide an accurate reading. Large mains may have as many as five hydrants; three is a normal count. One

hydrant in a system is a residual hydrant and is located the furthest from the supply mains.

5-26. To measure the pressure in a hydrant's system, remove the cap on a residual hydrant and install a Bourdon pressure gauge. Open the hydrant and record the pressure. During this test, water does not flow from the residual hydrant. The other hydrants tested in the system are called flowing hydrants. Remove one 2 1/2-inch cap from each flowing hydrant, and measure the outlet diameters to the nearest 1/16 inch. Open the valves of all hydrants in the test group in succession, and read the pressure at all hydrants. The pressure at the flowing hydrants is the velocity pressure. The pressure at a residual hydrant is the pressure that remains in the system. The pressure at a residual hydrant depends on the number of flowing hydrants.

5-27. You can use a pitot tube to measure velocity pressure more accurately. Hold a tube in the center of a water stream, 1 inch from the face of an outlet. Depending on the readings, adjust the openings of the flowing hydrants so that the pressure at the residual hydrant is at least 10 psi. Use these pressure readings to compute hydrant discharges. Use the following formula to obtain the discharge of each hydrant:

$$Q = av$$

where—
Q = amount of flow, in GPM
a = cross-section area of a stream, in inches
v = velocity of a moving stream, in psi

5-28. The total discharge is the sum of all pressure readings of all flowing hydrants in a system. Use DA Form 5384-R to calculate velocity pressure. The velocity cannot exceed 20 psi.

5-29. The capacity of an installation's distribution system is usually based on a residual pressure of 10 psi. Using the test data, compute the capacity at 10 psi pressure using DA Form 5384-R. The results should be the maximum rate at which water can be drawn from a system without reducing the pressure in it to less than 10 psi. Use the instructions below to complete DA Form 5384-R:

- Determine which scale you should use.
- Plot the total discharge on the chart.
- Plot the residual pressure on the chart.
- Indicate where these two lines intersect.
- Plot the static pressure on the vertical scale.
- Draw a straight line from the static pressure point through the residual pressure point on the water-flow scale.
- Read and record the GPM available flow at 10 psi per gallon.

5-30. The reading represents how much water is available if the pressure lost in a fire hydrant, hydrant branch, and pump-section hose is disregarded. A residual pressure of 10 psi is required when rating Army water systems.

SECTION III. FIRE PREVENTION DURING FIELD-TRAINING EXERCISES (FTXS)/ DEPLOYMENTS

5-31. During a FTX/deployment, a commander is responsible for fire prevention. He ensures that—

- A fire warden is appointed and actively supervises all fire-prevention measures during the FTX/deployment.
- Bivouac areas, including tents, are inspected daily for fire hazards.
- Fire hazards are eliminated and regulations are enforced. These include no storing of gasoline or diesel fuel inside a tent, no smoking in bed (or in a sleeping bag), and not placing clothing or other flammables close to lanterns, stoves, or stove pipes.
- Personnel are trained in using fire-fighting equipment, fire reporting, and fire prevention.
- Fireguards are posted. (One person, clothed and alert, will be designated as fireguard and will remain inside a tent when a heater or a gasoline lantern is burning.)
- Personnel are trained to operate and maintain POL-consuming devices properly.
- Candles and liquid-fuel stoves and lanterns are not left unattended while they are burning in a tent. (When all personnel in a tent are asleep, the stove, lantern, or candle will be turned off or put out.)
- Refueling of liquid-fuel equipment or devices does not take place in tents.

SMOKING

5-32. All personnel must be extremely cautious when disposing of smoking materials. During a summer FTX/deployment, a space will be cleared through the surface litter down to mineral soil. Cigars, cigarette butts, or pipe ashes will be placed in the cleared spot and ground into the soil until they are completely out. SMOKING IS PROHIBITED IN ANY VEHICLE and within 50 feet of any storage area. Personnel will never throw burning materials from any vehicle. Butt cans will be provided in bivouac areas and will be dumped into a pit covered with mineral soil or packed with snow daily.

MATCHES

5-33. Safety matches should be used. After striking any match, the person using it will break it and feel the burnt end, ensuring that it is completely out before throwing it away.

OPEN FIRES

5-34. When hazardous conditions exist, a unit commander will prohibit open fires. When the fire index is high, there will be no open burning. If using an open fire is part of a summer FTX/deployment, personnel will—

- Scrape flammable materials from an area 6 feet in diameter and dig a small hole in the center down to mineral soil for the fire.
- Keep the fire small and never build it against trees or logs or near brush.
- Have at least one person attend the fire at all times.
- Never use gasoline or kerosene to start or quicken the fire.
- Stir the coals while soaking them with water before leaving the fire. Likewise, they will turn and soak all sticks.
- Cover the fire pit with 6 inches of dirt that is free of leaves, twigs, and other vegetable matter. However, before covering the pit, they will make a final check of the ashes, ensuring that the fire is completely out.
- Never hang wet clothing over or close to an open fire unless they post a guard until the clothing is removed.

FLARES AND SMOKE GRENADES

5-35. Personnel who use flares or smoke grenades, or who are in an area where they are used or dropped, will locate the remains of the device and completely extinguish any burning residue and render any hot particles harmless.

HEATERS

5-36. Many units rely on heaters to keep their tents warm in the winter. If used properly, these heaters will perform well in all cold-weather regions. However, misusing heaters can cause and has caused many fatalities in the field. Commanders should ensure that only qualified personnel set up, operate, and refuel these heaters. Since flames can engulf most tents in less than 10 seconds, personnel must follow the procedures in the operator's manual and the guidelines discussed below:

5-37. When setting up and working with heaters, personnel must—

- Never refuel a heater that is in operation; spilled fuel could ignite.
- Always post a fireguard at night.
- Have fire extinguishers available in every tent that has a heater.
- Keep flammable materials such as pine needles or spruce boughs away from the heater.

- Always use drip pans. Without them, fuel drips directly on the ground and could ignite.
- Never block tent exits with meals, ready to eat (MRE) cases or water cans or by rolling snow flaps inside and holding them down with personal gear.

TENTS

5-38. When setting up and dealing with tents, personnel must—

- Space all 5- and 10-man tents at least 10 feet apart. For larger tents, they should space them at least 30 feet apart.
- Keep areas in and around the tents as free of debris as possible and maintain the area at high standards. During the fire season, they must clear the grass and brush from within 3 feet of 5- and 10-man tents and within 10 feet of larger tents.
- Securely mount and fasten fuel cans at least 1 foot from the outside area of the tent. They must also equip fuel lines with drip interceptors.
- Be cautious when smoking or using flame-producing objects around tents. Tents are not fire-resistive; they are flame-retardant, which prevents rapid burning. They could be damage beyond economical repair if exposed to but not destroyed by fire.
- Not use duct-type heaters (Herman-Nelson type) inside a tent or structure. If they do use this type heater, personnel must ensure that a minimum of 15 feet is between a tent or structure and the heater. They must also ensure that the heating ducts are insulated with noncombustible material where they enter a tent or structure. Personnel must not refuel the heater until they can touch the combustion chamber with their bare hand. They must clean up all spills before refueling the unit.
- Install heaters according to the appropriate TM.

VEHICLES

5-39. When dealing with vehicles during a FTX/deployment, personnel will—

- Not refuel a vehicle while the engine is running or within 50 feet of any flame-producing equipment.
- Ensure that vehicles are a minimum of 10 feet between each other during refueling. Personnel will also ensure that a grounding cable is connected between the dispensing and receiving vehicles.
- Not park vehicles within 10 feet of any tent or storage rack.
- Not stop or park vehicles in areas that have established fires lane. However, personnel can load or unload vehicles in these areas, but they must ensure that the vehicles are constantly attended.

STORAGE AREAS

5-40. When considering and dealing with storage areas during a FTX/ deployment, personnel will—

- Select sites that have minimum vegetation. During the fire season, they will remove or cut and maintain grass and brush to a 2-inch height limit within the storage area and 20 feet around it.
- Limit storage piles to stacks that are 6 feet high, 10 feet wide, and 20 feet long. They will ensure that the ends of the stacks are at least 10 feet from each other and that they have 20-foot wide fire lanes between the long sides.
- Maintain POL storage areas according to the TMs. They must ensure that these areas are at least 50 feet from any tent or equipment and in a location so that drainage (in case of a leak) will be away from inhabited areas.
- Post special caution signs, when required by what is being stored.
- Police the area thoroughly every day, and remove all rubbish/trash to the disposal pit area.
- Store reusable containers in separate piles.
- Store containers that hold flammables in a POL area, ensuring that the lids are tightly closed.
- Store ammunition in igloos or in isolated areas that the ammunition surveillance officer has approved.

CAMOUFLAGE

5-41. When dealing with concealing materials and devices from air-to-ground observation, including nets and foliage, during a FTX/deployment, personnel will—

- Not install camouflage within 1 foot of any muffler or exhaust system or any other surface that may be heated under normal operating conditions. They will securely fasten all materials that are near such surfaces.
- Not start the engines of camouflaged equipment until they inspect the equipment to ensure that all combustible material is clear of the exhaust and its discharge.
- Frequently inspect camouflage material to ensure that it is securely moored so that the wind or moving mooring points will not allow any material to drop on a hot surface.
- Keep the open flames of all cooking equipment at least 5 feet away from any camouflaged material.

DISTRIBUTION OF FIRE EXTINGUISHERS

5-42. During a FTX/deployment, fire extinguishers are required as follows:

- Mess tents—two 20-pound ABC extinguishers.
- POL—four 20-pound ABC extinguishers per 15,000 gallons of POL.
- Herman-Nelson heaters—one 2 1/2-pound BC extinguisher, or equivalent.
- Vehicles—as per AR 385-55, paragraph 22.
- Maintenance tents—two 20-pound ABC extinguishers per tent.
- Sleeping tents—one 2 1/2-pound dry-chemical extinguisher, minimum, if the tent contains any heat-producing device or open flame.

Chapter 6

Water-Tanker Resupply Operations

6-1. Fixed water-supply systems in a combat environment will be rare. Fire-fighting teams must be able to locate and plot all possible water sources on a map. These areas must be secure and accessible, and if possible, have more than one route to and from the site. Relying on water tankers and temporary water supplies will be the standard operation. Water tankers are allotted one per LB team.

MISSION

6-2. The mission of an LC team is two-fold. The primary mission is to provide LB teams with an additional water supply and to maintain temporary water-supply points when in place. An LC team must also be aware of water-resupply points and drafting locations.

RESUPPLY OPERATIONS

6-3. When LB teams deploy to an emergency, an LC team will respond simultaneously. Once the LB teams are in position, the LC team will set up to resupply the primary fire-fighting unit. It can do this either through a direct connection or by using a resupply portable drop tank, if available. Once the tanker's water tank is empty, the crew will go to the closest water resupply/ drafting point and reload the water tank. Meanwhile, a second tanker, if available, will be supplying the fire-fighting units.

TEMPORARY WATER SUPPLY

6-4. Temporary water-supply points will be constructed, when possible, in high-risk areas. Each will hold 3,000 gallons of water. Temporary water-supply points can be constructed from 3,000-gallon water-storage bladders or lined open-top pools. The bladders or pools should be clearly marked as shown in Figure 6-1.

For Fire-Fighting Use Only, Nonpotable.
Water-supply vehicle must have clear access into temporary water-supply sites.

Figure 6-2. Sign markings for bladders or pools

DRAFTING SITES

6-5. All team members should be familiar with the locations of the water-supply points. Drafting sites should be located during reconnaissance of an AO and recorded on the response plans. These sites should be deep enough to sustain continuous operations. Access to the sites should be able to sustain continuous traffic of fully loaded water-supply tankers. Team members must be careful when positioning the vehicles along side of the stream bank. The banks along a lake or stream are often very unstable, and improper positioning could result in the vehicle sliding or even overturning into the water.

6-6. When selecting a drafting site, an LC team must ensure that the flow is sufficient to support the draft. For example, an average stream that is 10 feet wide and 1 foot deep will need to flow about 15 feet per minute (fpm) to supply a 2500L fire truck. The team can measure the flow rate by throwing a stick into the stream and measuring the distance that it floats in 1 minute.

6-7. An area the size of a football field (120 by 50 yards) that is at least 1 foot deep will supply a 2500L for about 5 hours of continuous pumping. An LC team should keep those figures in mind when looking at a lake or pond as a possible drafting site. If an area has irrigation canals, the team should use them first. The flow from such canals is over 1,000 GPM, and they usually are easily accessible.

6-8. An LC team must maintain security during drafting operations at all times. A drafting site is the most vulnerable area because it is usually away from the incident site, and only a minimum number of crew members maintain security. If possible, a security team should assist when an LC team must resupply.

FIRE-FIGHTING OPERATIONS

6-9. An LC team performs several fire-fighting operations. It—

- Will assist LB teams in fire-fighting operations when required, unless it is involved in water-supply/shuttle activities. When an LC team arrives at an incident site, the senior crew member will report to the SFO for crew assignments and instructions.
- May also fight wildland fires as a single unit or with LB teams or other engineer assets. Because of this, an LC team needs to maintain a minimum of 200 feet of 1 1/2-inch attack line with a combination nozzle on its tanker.

Chapter 7

Aircraft Crash/Rescue Fire-Fighting Operations

7-1. Aircraft rescue fire-fighting operations will include aircraft incidents and accidents, MEDEVAC, search and rescue, refuel/defuel, and maintenance standby operations.

AIRCRAFT CRASH OPERATIONS

7-2. An aircraft crash/rescue team provides support to Army aviation and to Air Force, Navy, Marine, allied, and civil aviation assets in support of Army operations. The types of support include, search and rescue, emergency evacuation, forward arming resupply point (FARP), and basic life support.

7-3. The standard requirement for crash/rescue operations will be a minimum of one LB team and one LC team. Aircraft that are over 10,000 pounds, have a normal fuel load over 400 gallons, or have an average load of 12 or more persons will require two LB teams and one LC team, as a minimum. Additional LB teams can be assigned, if available.

AIRCRAFT EMERGENCY NOTIFICATION

NOTIFYING THE CONTROL TOWER

7-4. When notified of an emergency, the control tower will immediately contact the FCC. The center will then dispatch the required response teams and notify the subordinate support units. The control tower will supply as much of the following information as possible:

- Location and nature of the emergency.
- Type of aircraft.
- Amount of fuel on board.
- Number of personnel on board.
- Types of hazardous cargo (explosives, radioactive, flammable, and/or toxic).
- Estimated time of arrival.

7-5. The control tower must relay this information to the FCC as it becomes available. The FCC transmits the information to the responding crews. Fire-fighting crews will then proceed to predetermined standby positions alongside, but clear of, the designated runway. Drivers and crews must be ready to reposition as required.

NOTIFYING OTHER PERSONNEL

7-6. When other personnel are notified of an emergency, the FCC will notify the control tower. When cleared from the tower, the FCC will then notify the

responding fire-fighting units. The dispatcher should try to get as much information as possible from the caller.

STANDBY AND RESPONSE OPERATIONS

7-7. During emergencies and hazardous conditions, fire-fighting equipment and crews will be stationed in the immediate vicinity of an aircraft or its anticipated landing point. While on standby status, personnel will prepare the equipment to maneuver and discharge the extinguishing agent without delay. Fire-fighting crews will provide standby service according to the degree of risk involved. The degree of risk and the response involved are as follows:

- Severe risk (all fire-fighting and rescue assets respond immediately). Situations at this level include aircraft crashes or serious accidents, emergency landings, and large fuel spills (over 100 gallons).
- Moderate risk (one fire-fighting vehicle and crew will respond or stand by). Situations at this level include medium fuel spills (5 to 100 gallons), continuous fuel leaks, MEDEVAC aircraft activities, loading munitions, welding aircraft, and working on open fuel cells.
- Mild risk (no standby required, fire-fighting crew[s] will maintain an alert status). Situations at this level include helicopter auto-rotation exercises, routine flight activities, routine maintenance activities, engine starts, and small fuel spills (under 5 gallons).

COMMUNICATIONS

7-8. An installation should have at least two methods of receiving incoming emergencies. The following describes several methods:

- A primary crash line is a direct two-way communication line between the control tower and the FCC that can be activated from either location. Other facilities that should be on a primary crash line are medical and security assets, base operations, and the HQ (commander's staff).
- A secondary crash line is any other two-way communications system between the tower and the FCC. A two-way radio or regular phone lines are normal. A secondary system is a back-up system to a primary one in case of damage or failure.
- A light signal system is a system of light codes (no vocal communications) that a tower uses to signal vehicles and aircraft on an airfield (see Figure 7-1).
- An airfield-flag method is used when vehicles do not have warning lights but may be equipped with high-visibility flags so that aircraft can see them on an airfield. The base operations will issue the flags to vehicle operators once they receive clearance to be on an airfield.

Color and Type of Signal	Meaning		
	Aircraft on the Ground	Aircraft in Flight	Movement of Vehicles, Equipment, and Personnel
Steady green	Cleared for takeoff	Cleared to land	Cleared to cross, proceed, go
Flashing green	Cleared to taxi	Return for landing (to be followed by steady green at the proper time)	Not applicable
Steady red	Stop	Give way to other aircraft and continue circling	Stop
Flashing red	Taxi clear of landing area/ runway in use	Airport unsafe - do not land	Clear the taxiway/runway
Flashing white	Return to starting point on airport	Not applicable	Return to starting point on airport
Red and green	General warning signal - exercise extreme caution		

Figure 7-1. Airfield light signal system

AIRCRAFT-ACCIDENT EMERGENCY TEAMS

7-9. Aircraft-accident response teams should be made up in three separate groups. The following lists the personnel in each group:

- Group I (personnel are required to participate in operations immediately). This groups consists of firefighters and crash/rescue and medical personnel.
- Group II (personnel are required to perform related support services as circumstances may develop). This group consists of maintenance and wrecker personnel, a provost marshal, MP or guard personnel, photographic personnel, and an aviation safety officer.
- Group III (personnel are required to attend if their specific duty performance is needed). This group consists of an installation or airfield commander, an installation fire marshal, aircraft-accident personnel, chaplains, investigation personnel, and public affairs personnel.

7-10. An installation commander should contact EOD personnel for help in identifying and rendering safe all explosive hazards associated with an aircraft. Aircraft carrying explosive cargo will require an EOD response for technical help and disposition of explosive hazards.

EMERGENCY RESPONSE

ON AN AIRFIELD

7-11. When a potential or an actual emergency occurs on an airfield, the following emergency crews will respond accordingly:

Fire-Fighting and Rescue Crews

7-12. The duties and responsibilities for personnel in this group are listed below:

- The crew member who receives the notification of an emergency will immediately dispatch and advise all other crew members of the nature of the emergency.
- Designated fire-fighting and rescue units on duty will respond immediately. If an alert is for a potential emergency, fire-fighting crews will align attending vehicles near the runway at predetermined points for prompt action. Placement of the fire-fighting equipment along a runway could be based on the nature of an aircraft emergency and the type of aircraft involved. Crash/rescue aircraft may be started and flown to standby positions.
- Vehicles will not proceed onto a runway without clearance from the control tower. Taxiing aircraft will stop and will not proceed without clearance from the tower.
- Fire crews will respond to the crash site immediately after an aircraft impacts. They should approach the site cautiously, watching for injured personnel and casualties.
- Crash crews will need grid maps to locate emergencies that occur off an airfield. When necessary, the responding aircraft should locate the crash site and then guide fire and rescue crews to it. When not directing fire trucks, the aircraft will circle the crash site until released by the on-scene fire official.

Medical Personnel and Ambulance Crews

7-13. The duties and responsibilities for personnel in this group are listed below:

- The designated medical officer, ambulance crews, and emergency room personnel will be alerted when notified of an impending or an actual aircraft emergency.
- The designated medical officer and ambulance crews will respond to an accident site unless the SFO has notified them that their services are not required.
- Off-post/HN medical and ambulance services will be requested as required.

Fire Chief or SFO

7-14. The fire chief or SFO will—

- Respond to the scene of the emergency immediately when notified.
- Assume direct command of the fire-fighting and rescue operations when he arrives at the site.
- Determine if additional assistance from other on- or off-post organizations is required.

Provost Marshal, MP, or Guard Personnel

7-15. The personnel in this group will—

- Proceed to the scene of an accident.
- Secure the scene from unauthorized entry of personnel.
- Prohibit smoking or open flames in the vicinity of an accident site.
- Establish traffic-control points into and out of an accident site.
- Establish guard posts to control the security of the perimeter of an accident site.

Aviation Maintenance Officer

7-16. An aviation maintenance officer will assist the accident investigation team as required.

Photographic Personnel

7-17. Photographic personnel will—

- Respond to an accident site and record as much physical evidence as possible.
- Assist an accident investigation team, as required.

Aviation Safety Officer

7-18. An aviation safety officer will—

- Respond to an accident site.
- Ensure that the request reports are submitted.
- Ensure that an investigation is conducted according to AR 385-95.

Chaplains

7-19. The chaplains will respond to an accident scene, when requested, and will provide services as required.

Public Affairs Officer

7-20. A public affairs officer will—

- Respond to an accident scene, when requested.
- Maintain liaison with the local news services.
- Issue news releases, as required.

Off an Airfield

7-21. When a potential or an actual emergency occurs off an airfield, personnel involved in the operation will follow the guidelines below:

- Predesignated emergency response crews, when notified, will respond immediately after they are released from the tower.
- Any available aircraft in an area will be used to guide the emergency equipment into an incident site. These aircraft will also provide any advance information that they can about an incident site.
- Emergency equipment and personnel may have to be escorted through the community where an incident has occurred.
- All duties will be the same as an *on-an-airfield* response except that there will normally be more coordination with civilian authorities and agencies.
- Some damage-control guidelines should be put into place if an incident has occurred on private property.
- A larger security force may be needed because security at a site may be harder to maintain.
- Pre-arranged assistance agreements with local fire departments, medical-response facilities, and police agencies are important.

GRID MAPS

7-22. Each flight-operations office must have local-area grid maps. They should be of suitable scale and cover at least a 15-nautical-mile radius center on an airfield. Copies of the grid maps will be posted in each location where emergency calls are received. Additional maps will be located in each responding vehicle assigned to emergency crews. All supporting vehicles and aircraft identified in the airfield fire-fighting and rescue plan will also have grid maps.

7-23. All personnel assigned to the fire-fighting, rescue, and medical-support elements will acquaint themselves, as part of the training program, with the terrain surrounding an airfield. This includes becoming familiar with the locations and bearing capacity of the roads, bridges, culverts, trails, and other significant terrain features within a 15-nautical-mile area of the airfield. Personnel will do this through map orientation and personal inspection.

7-24. When notified of an incident, personnel will be given the location or section on the grid map. They will clearly identify the area and repeat the information back to the dispatcher. Emergency personnel will then locate the site on the grid map and respond. All personnel assigned to the emergency crews will be proficient in reading and locating points on a grid map and in being able to navigate to those points.

SCHEDULED AEROMEDICAL EVACUATION

7-25. At installations where fire-fighting crews and equipment are available, fire crews will—

- Be notified of aeromedical evacuations in advance to permit mobilization. At least one LB fire truck with crew will respond.
- Take a strategic position for rapid response in case of a landing or a takeoff accident.
- Stand by in the immediate area of an aircraft when incapacitated patients are onboard and during loading and unloading.
- Ensure that an aircraft is not fueled when patients are onboard except when absolutely necessary.
- Be required to stand by during takeoff, landing, loading, and unloading of patients and during refueling operations. Crew members will position the fire trucks to provide maximum fire protection to personnel and the aircraft.
- Follow an aircraft, during takeoff, to the run-up area and remain there until it is airborne. A crash crew will remain on alert status until an aircraft clears the traffic pattern.
- Follow an aircraft from the ramp to the parking area during landing. The fire crews will position themselves to provide maximum coverage of the rescue paths, personnel, and aircraft. Fire crews will remain on standby until all patients have been loaded or unloaded.

SEARCH AND RESCUE OPERATIONS

7-26. Fire-fighting personnel might conduct search and rescue operations with aviation personnel and assets. If they do, they will perform rescue and life-saving procedures from an aircraft and/or with an aircrew.

EMERGENCY EVACUATION OF THE INJURED

7-27. Firefighters can assist in the emergency evacuation of the injured. (Such a duty is not considered primary for them.) They are trained in basic life support and first-responder-level medical care.

FARP OPERATIONS

7-28. Fire-fighting teams will support aviation units as required. Security will be a primary concern when operating in a forward area; therefore, fuses will be removed from the sirens and emergency lights. Fire-fighting crews will subdue all highly visual areas on the truck with materials available. All driving will be conducted under blackout conditions. Fire protection will be limited to rescuing personnel in the event of a crash and suppressing fires of mission-essential equipment and resources. When operating out of the immediate area of the FARP, a security force must be provided.

HAZARDOUS MATERIALS

7-29. The following list describes some HAZMATs associated with aircraft:

- Liquid and gaseous oxygen. Oxygen is a powerful oxidizer in the liquid and gaseous states. It is colorless, odorless, and slightly heavier than air. Liquid oxygen is pale blue and slightly denser than water.
- Hydrazine. At room temperature, hydrazine is a clear, oily liquid with an odor similar to ammonia. It is a health hazard in the liquid and vapor forms. Hydrazine is combustible and explosive.
- Beryllium. In a dust or powder form, beryllium is a silvery material resembling aluminum powder.
- Magnesium. Magnesium is a silvery metal that looks like aluminum but is lighter in weight.
- Depleted uranium. Depleted uranium is used as counterweights in some aircraft. The weights are coated for protection.
- Ammonia. Anhydrous ammonia is 99.5 percent (by weight) basic ammonia (NH_3) and is normally a pungent, colorless vapor.
- Liquid hydrogen. Liquid hydrogen is a nontoxic, transparent, colorless, and odorless liquid of low viscosity.
- Nitrogen tetroxide. Nitrogen tetroxide fumes vary in color from light orange to reddish brown to blue or green, at low temperatures.
- Carbon-graphite composite fibers. Composite fibers are bonded together for strength to form parts for aircraft. The majority of all operational aircraft now in use contains composite fibers in varying amounts and locations.
- Sulfurhexaflouride gas (SF-6). SF-6 is colorless, tasteless, and nontoxic. It is heavier than air and is nonflammable and noncorrosive. This gas reacts with water to form hydrofluoric acid.
- FC-77. FC-77 is a nonreactive, noncorrosive, nonflammable inert liquid. When heated above 572°F or when electricity is passed through the solution, some forms of nerve gas may evolve.
- Triethylborine (TEB*)*. TEB is used as a fuel additive to provide rapid ignition of a nonhypergolic fuel or propellant. It is an extremely toxic and volatile liquid with a sweet, pungent odor.
- Lithium thionylchloride. This HAZMAT is a soft, silvery, highly reactive metallic element that is used as a heat-transfer medium in thermonuclear weapons and alloys.

AIRCRAFT PREFIRE PLANS

7-30. Aircraft prefire plans are located in Appendix B. All Army aircraft and primary Air Force aircraft that support Army operations are listed. Additional information can be located in Air Force Technical Order (TO) 00-105E-9 and Soldier Training Plan (STP) 5-51M14-SM-TG.

TECHNIQUES AND PROCEDURES OF FIGHTING AIRCRAFT FIRES

7-31. AR 420-90 states that training will be conducted according to DODI 6055.6. All personnel conducting airfield fire-fighting duties shall be DOD certified at the level of airport firefighter. Supplemental training will be conducted from the STP 5-51M14-SM-TG and IFSTA Manual 206.

AIRCRAFT FIRE-FIGHTING AND CRASH/RESCUE

7-32. Rescuing aircraft crash victims takes precedence over all other operations until no further life hazards are involved. After rescuing victims, firefighters extinguish fires and limit further damage to an aircraft. Each rescue situation is different, and the SFO has the authority to change procedures and use all the equipment and resources available to complete a rescue. All installations will create and enact prefire plans to handle crash and rescue emergencies.

AIRCRAFT ENGINES

7-33. Fixed-wing aircraft will have an opposed-cylinder or turboprop, single- or multiple-engine configuration. Helicopters will have a gas-turbine, single- or multiple-engine configuration. A turboprop engine creates the same type of thrust that a jet engine creates; therefore, do not approach the aircraft from the rear or around the exhaust. Short circuits in the electrical systems and broken fuel and oil lines are the main sources of fires in gas engines. During start-up and shutdown of a gas engine, you should watch for fuel being drained or pumped through the engine.

AIRCRAFT SYSTEMS

7-34. Many of the systems in an aircraft can be potential fire hazards. Component systems in an aircraft include the following:

- Fuel.
- Installed fire extinguishing.
- Electrical.
- Hydraulic.
- Oxygen.
- Anti-icing.
- Canopy jettison.
- Seat ejection.
- Escape.
- Ordnance.

7-35. To prepare for aircraft accidents, firefighters must recognize all the systems and potential hazards in an aircraft. Figure 7-2, page 7-10, shows the color-code designations on the pipes for some of the aircraft systems. For safety, firefighters should know the color codes before entering a damaged aircraft.

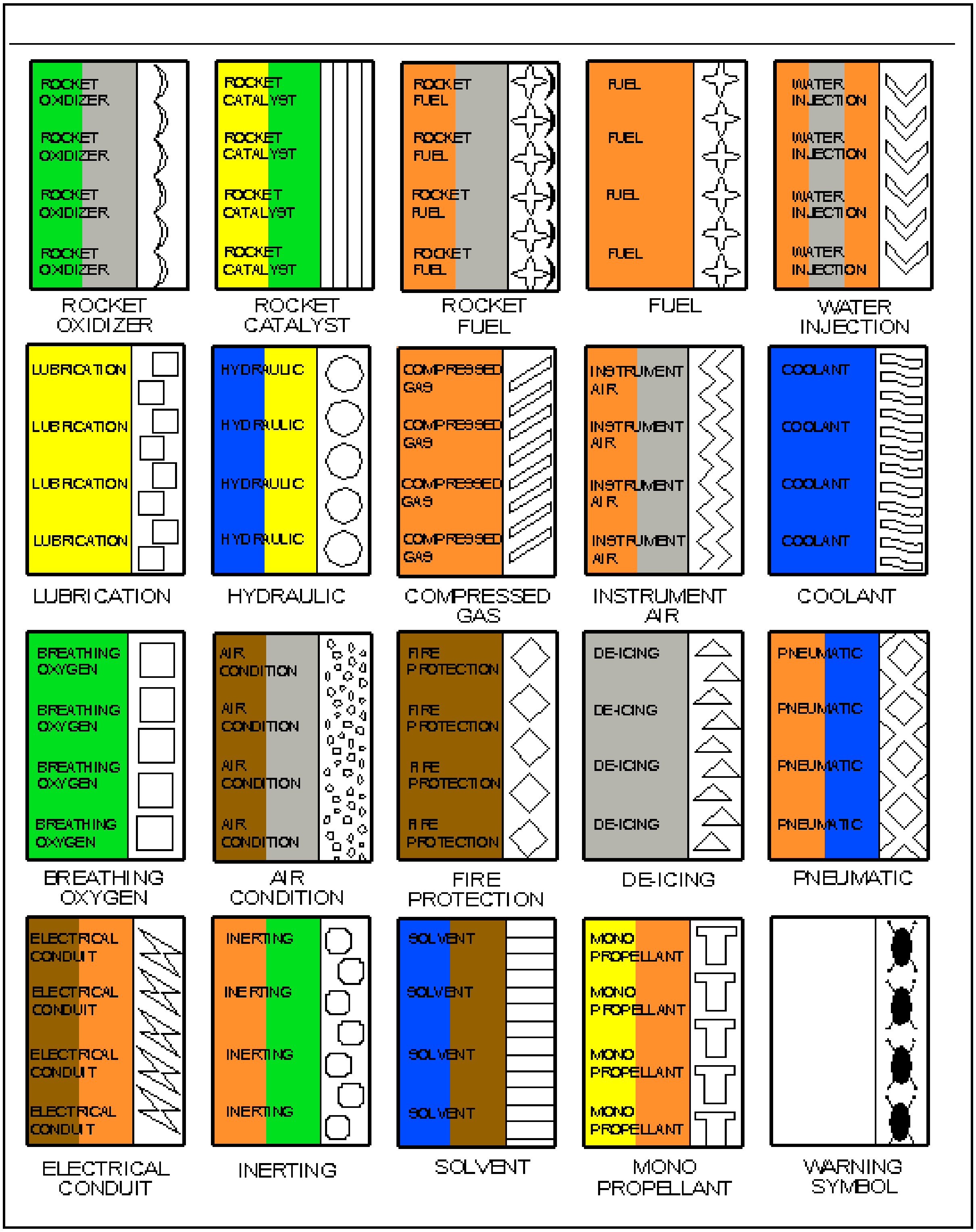


Figure 7-2. Color symbols for extinguishers

FUEL

7-36. A fuel system stores and distributes fuel to the engines. Fuel tanks, portable bladders, lines, control valves, pumps, and other components are located throughout an aircraft. Newer aircraft are equipped with a crashworthy fuel system that contains self-sealing tanks, breakaway valves, and fuel vent lines. Although crashworthy, this system may still leak fuel. When an aircraft crashes, the force of the impact can rupture fuel lines and tanks. Sparks, electrical short circuits, static-electricity discharges, hot surfaces, and hot exhaust gases are possible ignition sources.

7-37. Fuel tanks may be separate units installed between an aircraft's structural framework or built in as part of a wing. In fixed-wing aircraft, fuel tanks are usually located in the wings and possibly in the fuselage. In most helicopters, the fuel tanks are located in the fuselage. Some aircraft carry auxiliary fuel tanks located under the wings or in the cargo area. Upon severe impact, these tanks usually rupture and set the entire fuselage on fire. Fuel lines in Army aircraft are quick-disconnect, self-sealing types. Some fuel systems are pressurized to maintain a steady fuel flow. When these systems develop leaks or broken lines, fuel may spray out and create a major fire hazard.

INSTALLED FIRE EXTINGUISHING

7-38. Many aircraft are equipped with this extinguishing system. A pilot can activate the system to extinguish fires throughout the aircraft. The system consists of pressurized containers, tubing, nozzles, fusible devices, and electrical or mechanical appliances for controlling the agent.

ELECTRICAL

7-39. This system supplies the current for all the electrical and avionics equipment. The principal fire hazard is the electrical wiring short-circuiting or arcing. In a crash, a large number of wires could be torn or damaged. Moving the aircraft could produce sparks that ignite fuel vapors.

7-40. Batteries are usually located in the fuselage, wings, or engine nacelle. Before an aircraft is moved after a crash or a fuel spill, disconnect and secure the battery and the battery cable ends. Alkaline or nickel cadmium batteries can overheat from internal shorting or thermal runaway. When a crash crew detects an overheated battery, they should use the following guidelines:

- If flames are present, use available extinguishing agents.
- If flames are not present but smoke, fumes, or electrolytes are emitted from the battery or vent, lower the battery temperature using a water fog and ventilate.
- If flames, smoke, gases, or electrolytes are not emitted from the battery or vent tubes, ventilate.

HYDRAULIC

7-41. This system consists of hydraulic-fluid reservoirs, pumps, various appliances, and tubing. A pressure pump moves the hydraulic fluid through the piping system. The hydraulic systems will remain pressurized even though the engines have stopped. You must be cautious not to cut pressurized

hydraulic lines during rescue or fire operations. When a pressurized hydraulic line ruptures or is cut, the fluid is released in a highly flammable fine mist. When sprayed on the hot brakes, exhaust, or electrical components, the fluid may ignite.

OXYGEN

7-42. Aircraft used for high-altitude operations have an extensive oxygen-supply system for life support and propulsion. The oxygen is stored in a gaseous or liquid state. Army aircraft use either a fixed or portable oxygen system. Oxygen may be found in one or more containers located in the fuselage. Aircraft equipped with high-altitude ejection seats will have small, gaseous oxygen bottles as part of the survival kits. These bottles are for emergency use when a crew member ejects at a high altitude or when the normal oxygen system fails. You must recognize oxygen containers that have been ripped from their locations by the impact of the crash. Leave the containers where they are and cordon off the area until trained personnel remove the containers.

7-43. Two hazards exist with the oxygen systems: explosion and the increased availability of oxygen to support combustion. Oxygen intensifies fuel burning as it is present. Danger of explosion is caused by the mixture of liquid oxygen with flammable materials.

7-44. Another explosive situation occurs when the oxygen-storage tank or liquid-oxygen (LOX) container is exposed to intense heat or severe impact. LOX is light blue and transparent and has a boiling point of -297°F. By itself, it is not flammable, but it does contribute to the combustion of other materials. When fighting fires involving LOX, cut off the fuel or oxygen supply. Blanketing or smothering agents are ineffective against LOX.

ANTI-ICING

7-45. Anti-icing fluids are usually an 85 percent alcohol, 15 percent glycerin mixture; however, some systems will use a 100 percent alcohol mixture. The location and size of the tanks containing anti-icing fluids vary with aircraft type. Separate tanks are provided for alcohol and alcohol-glycerin mixtures. Single-engine aircraft and helicopters usually carry 3 to 4 gallons; larger aircraft may carry from 6 to 40 gallons of anti-icing fluids. Although anti-icing fluids are not considered great fire hazards, their presence must be considered because of the alcohol in the system.

ORDNANCE AND AIRCRAFT

7-46. Ordnance in or on aircraft (small-arms ammunition, missiles, rockets, flares, or bombs) can be cargo or armament. You must identify aircraft carrying ordnance to prevent injuries during fire-fighting and rescue operations. Cargo of hazardous munitions and armament are classified by their reaction characteristics. See Chapter 11 for more information on fighting

HAZMAT fires. Ordnance materials are stored in various areas on aircraft. The following lists some general locations for specific aircraft types:

- Under the wings and inside or along the fuselage in a fighter.
- In the forward or aft fuselage in a cargo plane.
- Under the wings and in the bomb bay in a bomber.
- Under the wings and in the nose in a helicopter.

SPECIAL HAZARDS

7-47. Crash-rescue personnel have no problem categorizing rockets, missiles, bombs, and cannons as explosive hazards. However, there are other hazards which are explosive and can be just as lethal as any bomb or rocket. These are aircraft ejection seats, canopy jettisons, and explosive canopies. Almost all Air Force fighters have canopy jettisons and/or ejection seats. The Army's OV-1 Mohawk has a Martin-Baker ejection seat. The AH-64 Apache and AH-1 Cobra helicopters have explosive charges built into the canopies. The aircrew or rescue crew can activate the charge. Both of these hazards require firefighters to become very familiar with procedures to disarm them or place them on safety. Sometimes the situation is out of a rescue crew's hands. They may be subject to dangerous fragments when a pilot detonates the canopy or the force of a crash jettisons a seat. See TO 00-105E-9 for more information on how to handle these devices safely.

DANGER
Use extreme caution when approaching aircraft known to have special hazards!

FLAMMABLE MATERIALS IN AIRCRAFT

7-48. The following materials carried in aircraft can cause problems for firefighters:

- Aviation gasoline (AVGAS), jet fuel, and hypergolic fuel mixtures.
- Hydraulic fluids.
- Bottled gas (oxygen).
- Anti-icing fluids.
- Pyrotechnics, ammunition, and other ordnance.
- Metals (magnesium), which were discussed above.

AVIATION GASOLINE

7-49. The flash point of AVGAS is about -49°F. It will give off enough vapors in any weather condition to form an ignitable mixture in the air, near the surface of the liquid. The vapor flammability limits in the air are between 1 and 7 percent, so very small amounts of AVGAS can form sufficient vapors to carry the flame away from the initial ignition. AVGAS flames will spread between 700 and 800 fpm. Autoignition occurs between 825 and 960°F.

JET FUELS

7-50. The two most common jet fuels firefighters encounter at an aircraft incident are Jet A and Jet B. Both can represent a significant hazard to the crash survivors and the firefighters. Firefighters need to know the characteristics of each fuel and the best way to extinguish a fire that results from either fuel and prevent reignition once the fire is out.

Jet A Fuel

7-51. This is a kerosene-grade fuel with a flash point between 45 and 95°F, depending on the mixture. Jet A fuel will mix with air above the flash point and become flammable when the fuel-to-air mixture is just under 1 percent. The upper flammability limit is just over 5 percent. Autoignition temperatures range from 440 to 475°F with a flame-spread rate of less than 100 fpm. Jet A fuels do not spread as rapidly as gasoline. Jet petroleum (JP) 5 is a Jet A fuel used in some military aircraft.

Jet B Fuel

7-52. This fuel is a blend of gasoline and kerosene with a flash point at -10°F. JP4 is a Jet B fuel used in military aircraft. Flammable limits range from 1 percent to just over 7 percent. The lower limit of 1 percent makes any fuel potentially dangerous when spilled. Autoignition temperatures range between 470 and 480°F. The flame-spread rate of Jet B fuels is 700 to 800 fpm. At higher temperatures, the flame-spread rate across any jet fuel is increased.

HYPERGOLIC FUEL MIXTURES

7-53. These fuels are mixtures of specific fuels and oxidizers used as propellants in some missiles and rockets. Hypergolic fuels are stored separately and ignite when they come in contact with each other, without an ignition source. Mixtures of fuels and oxidizers that do not react or ignite when combined are called anergols or are anergolic mixtures. The reaction time of hypergolic mixtures varies according to substance and temperature. However, in cold weather, combustion may be delayed until enough fuel and oxidizer accumulate in the firing chamber.

7-54. Other compounds, such as triethylaluminum (TEA) or TEB, react when air or oxygen is introduced. These chemicals are termed pyrophorics and must be maintained under an inert atmosphere. TEA and TEB are used as missile igniters. You must wear special protective clothing and use SCBA when fires involve oxidizers and fuels. Health hazards resulting from such fires include poisoning, frostbite, and chemical burns.

FUEL CHARACTERISTICS

7-55. Upon impact, aircraft fuel tanks may fail, creating fuel mists. The fuels readily ignite under aircraft impact conditions. Under these conditions, fuel mist is as equally flammable as fuel vapors. A constant threat of reignition (flashback) in fires involving large amounts of AVGAS or jet fuels exists. You must be aware of flashback possibilities.

AIRCRAFT INCIDENTS

7-56. Aircraft frequently develop minor difficulties while in flight. Even though appropriate action is taken on board to correct the problem, a standby fire crew is required on the airfield when the aircraft arrives. Other types of emergency situations that fire crews deal with are discussed below:

WHEEL, BRAKE, AND TIRE FIRES

7-57. These problems occur in fixed-wing aircraft. Wheels and brakes are compounds of combustible metals. Fire crews must know the procedures for suppressing fires consisting of these metals. During a fire, pressure builds in the tires. Fire crews should approach tires from the front or back, never from the side.

WHEELS-UP LANDINGS

7-58. These landings result from hydraulic-system failure or pilot error. This type of emergency may or may not produce a fire. Extreme heat from the friction between the aircraft and the ground and the ruptured fuel tanks and the lines could produce a fire.

WATER CRASHES

7-59. Fuel floating around an aircraft could come in contact with hot engine parts and ignite, making rescue of personnel difficult. Trapped air may keep the aircraft afloat, so any attempt to enter it should be made from under the waterline.

NOSE-DIVE CRASHES

7-60. The impact from a nose-dive crash is so disastrous that there is usually not much chance for rescue operations.

BUILDING CRASHES

7-61. These crashes present several problems:

- Fire spreads rapidly due to excessive fuel leakage over a wide area.
- Rescue operations involve the aircraft and the building.
- The area around the building should be searched and evacuated.
- Fuel could enter storm drains, and the fuel vapors could surface in other areas, creating other hazards.

HILLSIDE CRASHES

7-62. With these crashes, the aircraft could disintegrate or, if it hits obstructions, cartwheel and cause structural components to break away. Also, aircraft personnel may be thrown from the wreckage. Reaching these crashes is the main problem for rescue personnel.

HELICOPTER CRASHES

7-63. Helicopters are of light construction and will usually break up in a crash. The rotor system, undercarriage, and tail will disintegrate, leaving the cabin or fuselage. Fuel leaks are the main concern. Most of the helicopter's

controls are cable systems, and in a crash, these cables could entangle the crew and occupants.

NO-FIRE CRASHES

7-64. With these crashes, fuel spills or leaks are present but have not ignited. You should wear protective clothing, and all nonessential personnel should clear the area. As soon as possible, fire crews should apply a foam blanket, stop leaks, and secure or remove the ignition sources from the area.

RESPONSE PROCEDURES TO AN AIRCRAFT EMERGENCY

7-65. Responding crews must approach a crash scene cautiously. Aircraft personnel may have been thrown clear or escaped from the aircraft. When responding to an aircraft emergency, fire and rescue crews should consider—

- The best route to the scene.
- Alerting the support agencies.
- The terrain.
- The weather.
- The type of aircraft.
- The weapons or armament on board.
- The presence of HAZMATs.
- The type of crash.
- The obstacles at the scene.

FIRE-TRUCK POSITIONS

7-66. The SFO at the crash scene decides where to position fire trucks. The normal pattern is for turrets to cover the escape and rescue paths and for hand lines to cover the secondary paths. If the aircraft is carrying armament or has explosive jettison-type canopies, the SFO must be careful and cautious when deciding where to position the fire apparatus. When only one truck responds, the crew chief decides where to position the vehicle.

INITIAL ATTACK

7-67. The most effective method of quick attack is a mass application of extinguishing agents through large-volume turrets, with minimum use of hand lines. The priority in the initial attack is to open and secure rescue and escape paths and to keep any spilled fuel from igniting during rescue operations. When available, two rescue personnel will be at each entry point. They should enter and exit through paths maintained by the turrets and hand lines.

RESCUE ENTRANCES

7-68. The quickest way into an aircraft is through normal entrances. When this is not possible, rescue personnel will use emergency entrances or make cut-in entrances. Figure 7-3 shows aircraft access entrances.

Standard

7-69. Door configurations vary with aircraft type. Entrances may be located on either side or both sides of the fuselage. Aircraft door hinges are on the forward side and open outwardly. The opposite side of the door contains the latch mechanism. On most aircraft, the emergency-release mechanism is on the hinge side.

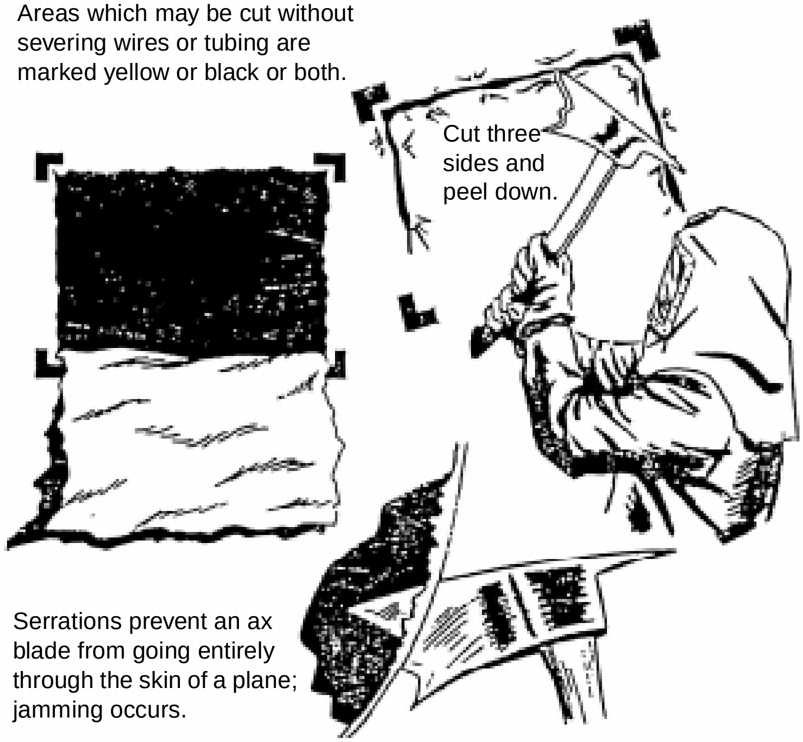


Figure 7-3. Aircraft access

Emergency

7-70. Some aircraft have escape hatches or escape panels made of thermoplastic polymer or metal. The hatches usually have an external release handle with the location and operating procedures marked on the adjacent surface of the fuselage. If the handle is inoperable or inaccessible, rescue personnel can use a crash ax and drive the pointed edge through the escape hatch or panel, close to the corner or edge. They will continue to use this procedure to knock out a section large enough for a swift entry.

Cut-In

7-71. Cut-in areas are indicated by broken yellow lines. These areas should be free of obstacles so that rescue personnel will not cut through heavy structural members or rupture fuel, electrical, or oxygen lines. Rescue personnel should cut fuselage skin carefully to prevent igniting fuel vapors. They will cut along three sides of the yellow lines and use the bottom as a hinge to pull the section outwardly (see Figure 7-4, page 7-18).

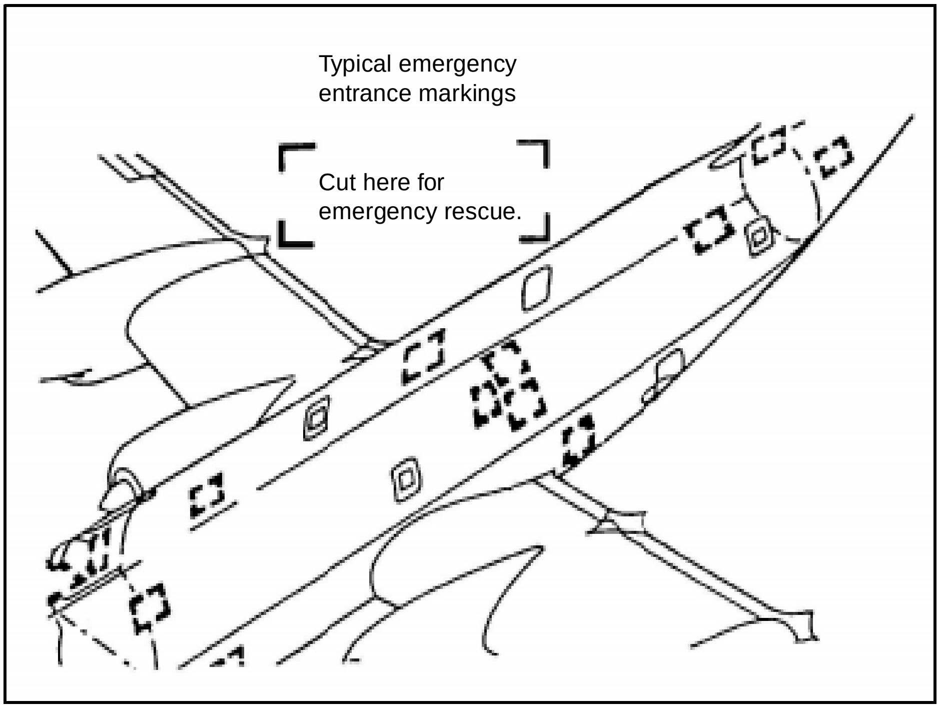


Figure 7-4. Emergency cut-in areas

VICTIM RESCUES

7-72. After gaining entrance, rescue personnel should locate and determine the condition of injured victims. If they cannot control hazards, they must evacuate the victims immediately. If evacuation is not possible, rescue personnel should attempt to keep the fire away from trapped victims. They must be careful when removing victims pinned in wreckage to prevent aggravating existing injuries or causing additional ones. If possible, they should obtain medical advice before moving injured victims. To remove a victim from the aircraft, one rescuer works from within or on the aircraft and another rescuer stays on the ground. The rescuer on the aircraft removes the victim from the aircraft and hands the victim to the rescuer on the ground. Together they carry the victim to safety.

7-73. All Army aircraft have seat belts and many have shoulder harnesses. Seat belts and shoulder harnesses are constructed of strong, webbed material and are difficult to cut. Rescue personnel must be familiar with the release mechanisms of these belts and harnesses. Figures 7-5 and 7-6 show different seat belts and shoulder harnesses. Figure 7-7 shows how to cut a harness.

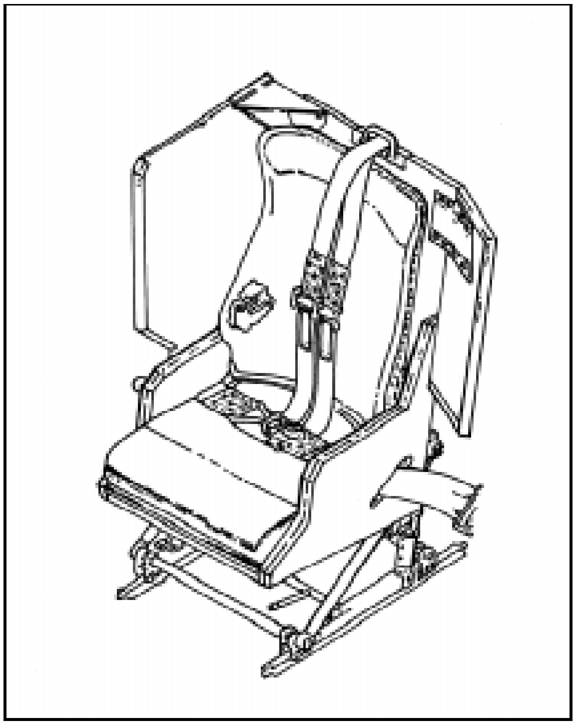


Figure 7-5. Seat belt and harness

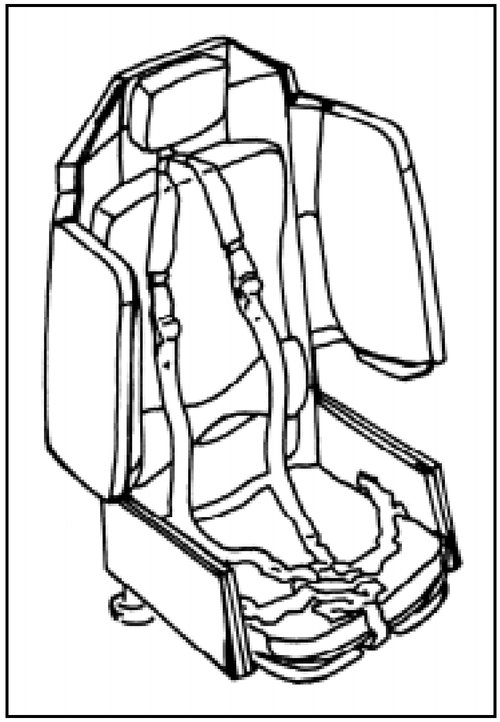


Figure 7-6. 5-point harness

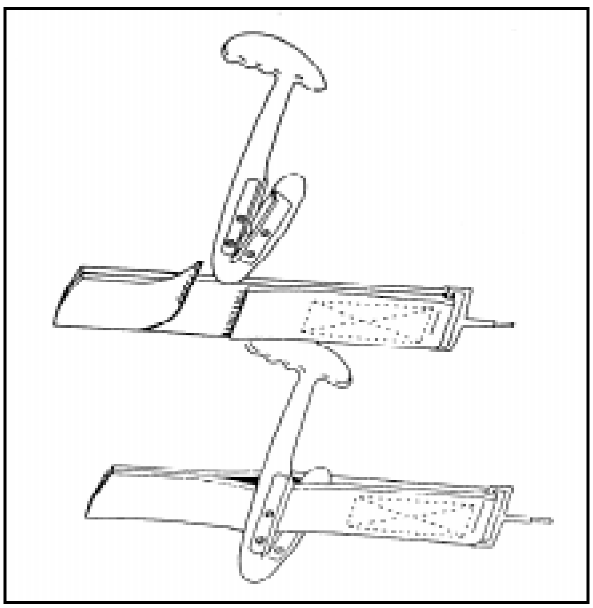


Figure 7-7. Cutting a double harness

EXTINGUISHMENT AND OVERHAUL

7-74. Extinguishment usually occurs after rescue personnel complete rescue operations. Tankers or backup crash trucks assist in applying water or extinguishing agents. Light and air units and wreckers or cranes are used when necessary. Rescue personnel must overhaul all aircraft, even if fire does not occur. Overhauling includes—

- Inspecting the aircraft thoroughly to ensure that no hidden dangers remain.
- Securing the electrical system and disconnecting the batteries.
- Tagging, removing, and relocating bodies. (Medical authorities usually perform this function.)

Chapter 8

Structural Fire-Fighting Operations

8-1. This chapter addresses many of the basic priorities and procedures that will be used throughout the rest of this manual for other fire-fighting purposes. The structural fire-fighting mission will include responding to all fire incidents that involve structures (including TO structures), tents, warehouses, and hangers. Responding to structural fires will be according to the fire-response chart. Factors such as total fire involvement, life hazards, fire-fighting resources, security, and mission-essential priorities will determine the type and degree of response.

SECTION I. FIRE OPERATIONS

8-2. Fire operations include all actions from the time a call comes into an FCC to the after-action review that is conducted following an incident. Responding to an incident, fighting a fire, rescue, and salvage/overhaul are considered components of fire operations.

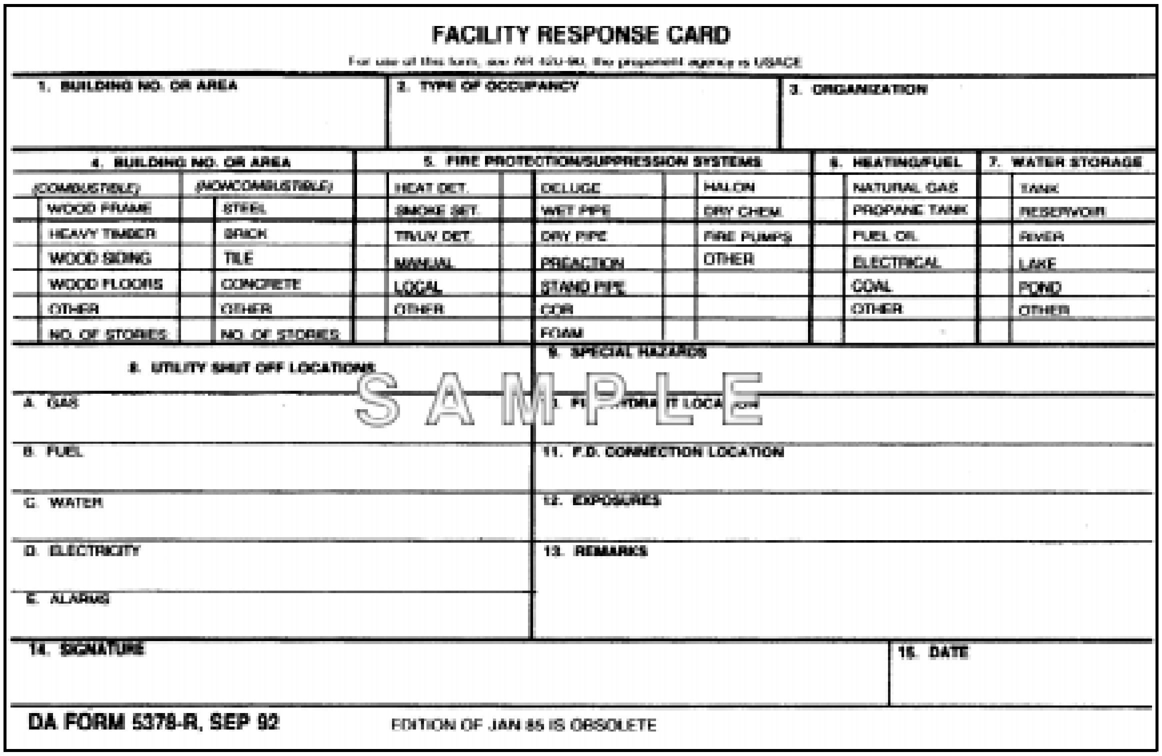
STRUCTURAL OPERATIONS

8-3. When a crew chief or an SFO arrives at a fire scene, he assesses the situation and decides what actions firefighters will take. The crew chief/SFO bases his decisions on different factors. Prefire plans list constant factors such as the type of building construction, the building's dimensions, or the fire-department connection/standpipe locations. The weather; traffic; use of the building; types of materials stored; and time, size, and location of a fire are changing factors.

8-4. Fire crews must conduct prefire plans on all high-priority/high-target facilities. Response routes (primary and alternate), water sources, hazardous areas, and an attack strategy can all be determined before an incident occurs. If the crew is familiar with the facilities, the fire-fighting operations could occur quickly. DA Form 5378-R (see Figure 8-1, page 8-2) should be filled out for this purpose. If the form is not available, the following information should be included on the prefire plan:

- Building identification.
- Construction type.
- Occupancy.
- Response requirements.
- Special hazards, such as HAZMATs storage and presence of significant quantities of asbestos.

- Water supply.
- Building sketch.



FACILITY RESPONSE CARD

For use of this form, see AR 420-90, the proponent agency is USACE

1. BUILDING NO. OR AREA
2. TYPE OF OCCUPANCY
3. ORGANIZATION

4. BUILDING NO. OR AREA		5. FIRE PROTECTION/SUPPRESSION SYSTEMS			6. HEATING/FUEL	7. WATER STORAGE
(COMBUSTIBLE)	(NONCOMBUSTIBLE)	HEAT DET.	DELUGE	HALON	NATURAL GAS	TANK
WOOD FRAME	STEEL	SMOKE DET.	WET PIPE	DRY CHEM.	PROPANE TANK	RESERVOIR
HEAVY TIMBER	BRICK	TR/UV DET.	DRY PIPE	FIRE PUMPS	FUEL OIL	RIVER
WOOD SIDING	TILE	MANUAL	PREACTION	OTHER	ELECTRICAL	LAKE
WOOD FLOORS	CONCRETE	LOCAL	STAND PIPE		COAL	POND
OTHER	OTHER	OTHER	COR		OTHER	OTHER
NO. OF STORIES	NO. OF STORIES		FOAM			

8. UTILITY SHUT OFF LOCATIONS
A. GAS
B. FUEL
C. WATER
D. ELECTRICITY
E. ALARMS

9. SPECIAL HAZARDS
10. FIRE HYDRANT LOCATION
11. F.D. CONNECTION LOCATION
12. EXPOSURES
13. REMARKS

14. SIGNATURE
15. DATE

DA FORM 5379-R, SEP 92 EDITION OF JAN 85 IS OBSOLETE

SAMPLE

Figure 8-1. Sample DA Form 5873

EMERGENCY NOTIFICATION

8-5. When notified of an emergency, the dispatcher should try to get as much information as possible from the caller. The FCC will dispatch the required response teams and notify the subordinate support units. The FCC will supply as much of the following information as available to the responding crews:

- Location and nature of the emergency.
- Number of personnel involved.
- Types of HAZMATs involved (explosives, radioactive, flammable, and/or toxic).

STRATEGY AND TACTICS

8-6. The strategy and tactics employed at a fire scene are based on the situation. The on-scene SFO's evaluation of the situation will dictate how, when, and where firefighters will attack or control a fire. The SFO's ability to evaluate the incident correctly will determine the overall success or failure of the fire-fighting efforts. Although there are SOPs for most fire-fighting incidents, the SFO must be prepared for rapid changes and adjust the

strategy and tactics accordingly. The following factors could have a large effect on those efforts:

ACCESSIBILITY TO A FIRE

8-7. Conditions such as mud, snow, evacuations, traffic jams, ditches across roads, and blocked alleys can prevent easy access to a fire. To prevent delays, the crew chief should check such conditions before fire crews depart to a fire.

FIRE-FIGHTING EQUIPMENT

8-8. Some fire emergencies require additional equipment and personnel. One way to determine the need for more equipment is for the SFO to observe the nature and extent of a fire's progress. Another way is to consider the volume of water or other extinguishing agents that are available in relation to the estimated requirements, which are annotated on the facility response card (prefire plan). To determine how much water is needed at a fire, use the following formula and example:

$$GPM = N\,(LW/3)$$

where—

GPM = amount of water needed for a fire
L = building length, in feet
W = building width, in feet
N = number of floors in the building

Fully involved building= 100%
50 percent-involved building= 50%
25 percent-involved building= 25%

8-9. To cover the exposures, take 25 percent of the fire flow for each exposure. For example, you have a fully involved two-story house that is 30 by 72 feet with two exposures. Multiply 30 by 72, divide by three, and multiply by 2 to get the total GPM needed to extinguish a fire. Take 25 percent of the fire flow for each exposure and add to the other GPM to get the total GPM needed for a fire.

BUILDING FEATURES

8-10. An SFO must consider the following factors to determine when a building could collapse:

- Type of construction (brick, wood, or aluminum siding).
- Percentage of the building involved in fire.
- Extent of the damages.
- Length of the burning time.
- Types and quantities of the materials in the building.
- Ability of the materials to absorb water and expand.

8-11. After assessing these factors, the SFO determines if the fire crews can use ladders or enter the building to fight a fire.

Protective Systems

8-12. The SFO should examine the building's protective equipment: sprinkler systems, fire doors, fire shutters, and wired glass windows. He should determine if these devices will be effective during a fire operation.

Exposure Hazards

8-13. The SFO examines exposures such as furnishings, adjacent rooms, or areas where fire spread is most likely, so that fire crews can effectively attack a fire. For example, if a fire is in the basement, a quick attack on the areas where the fire could spread could stop the fire.

8-14. Heat radiation or heated smoke and gases from the initial fire could endanger exposures such as the roofs and walls of adjacent buildings. In an advanced fire, fire crews must protect exposed buildings. They should consider the wind direction, the ground slope, the distance between buildings, and the extent of the fire's spread before taking action. However, life hazards, the content value, or the current need could determine the fire crews' actions.

Time of Emergency

8-15. The month, day, and hour are important factors in a fire emergency. For example, a fire in a school building at 0900 hours on a Tuesday in late September could present different problems than a fire in the same building at 2100 hours on a Tuesday in early July. Fire crews must know if people are in a building before beginning fire-fighting operations.

Hazards From Contents

8-16. The crew chief must determine if a building contains explosive stock, toxic fumes, chemicals, acids, compressed-gas cylinders, and high-voltage wires. When these items are heated or subjected to a hose stream, they could be a safety hazard.

STRUCTURAL FEATURES

8-17. Most modern buildings have continuous foundations of concrete, brick, or stone. The foundation wall that supports the frame construction may extend above the ground. Figure 8-2 shows arrangements of structural components.

Exterior Walls

8-18. The list below describes various types of exterior walls:

- Masonry walls. These walls are usually 8 to 12 inches thick, depending on the material used. Masonry walls provide the best fire protection.
- Masonry-veneered walls. These are frame walls that have wooden support members with one veneer of brick or stone. The upright, wooden support members in these walls are studs. Studs are usually 2- by 4-inch pieces, spaced at 16-, 18-, or 24-inch intervals. Fire stops are usually short, 2- by 4-inch wooden pieces placed in walls, ceilings,

partitions, and stairways between the studs at each floor level and at the upper end of the stud channels in the attic. Fire stops cut off the draft in the walls and help prevent fire and smoke from spreading. Figure 8-3, page 8-6, shows fire stops.

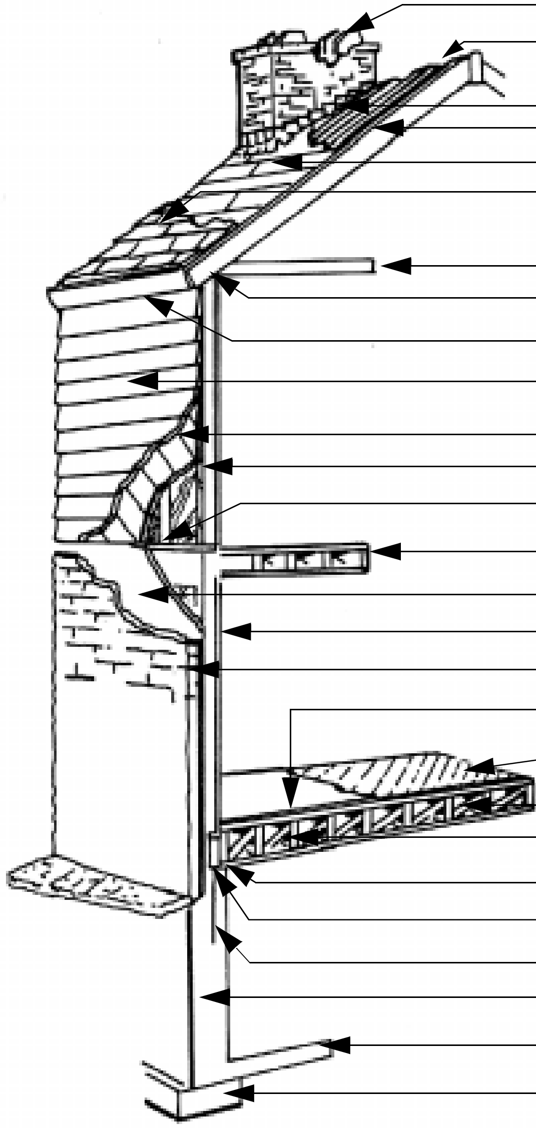


Figure 8-2. Arrangements of structural components

- Wooden-frame walls. These walls are constructed entirely of wood. The wood is usually treated with fire retardants to enhance the fire

resistiveness of the wood. Fire stops are of the same type and used in the same way as masonry-veneered walls.

- Metal walls. These walls are constructed of metal sections or panels and are fastened to wooden studs with bolts or screws. Metal walls may have a painted or porcelain-coated surface

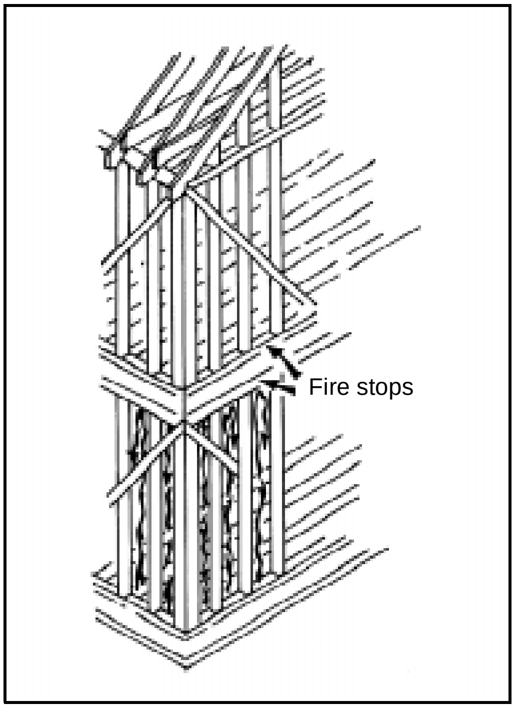


Figure 8-3. Fire stops

ROOFS

8-19. Roofs are constructed in layers using different materials. The main support comes from the rafters, which run at right angles from the beam and ridge of the roof. Sheathing covers the rafters. Sheathing is 4- by 8-foot sheets of 1-inch plywood or 1-inch boards. Thin metal sheets or felt paper is nailed over the sheathing. The final layer can be a layer of tar or asphalt, 4- by 8-foot metal sheets, or other types of waterproof coverings. Figure 8-4 shows different types of roofs.

Shingled Roofs

8-20. These roofs are made of small sections of material (wood, asphalt, fiberglass, or metal) that are fastened to sheathing. To open shingled roofs, strip off the shingles and cut away the sheathing.

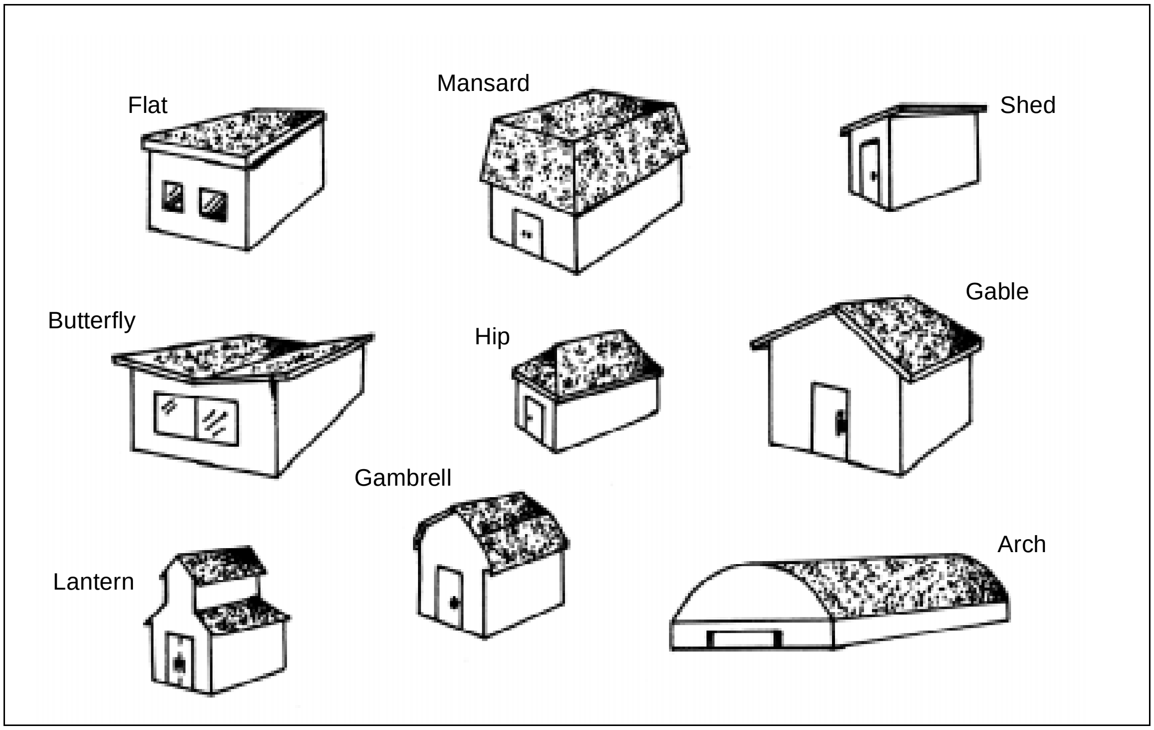


Figure 8-4. Roof types

Composition Roofs

8-21. These roofs are made of one to six sheets of roofing material nailed to the sheathing. Hot asphalt is spread over the entire covering and allowed to cool. To open these roofs, first cut and roll back the covering and then cut the sheathing close to the joists to make an opening.

Metal Roofs

8-22. These roofs are made of metal sheets that are crimped or soldered together and fastened to the sheathing. Use a pike pole or similar tool to open them. When using a fire ax to cut a roof, use short, quick, forceful strokes to prevent the ax from striking other fire personnel and from catching in overhead obstructions. Make diagonal cuts close to a joist or stud. Do not cut with the grain of the board.

8-23. In flooring, roofing, or sheathing, make a cut at a 60-degree angle instead of straight down. Cut diagonal sheathing the direction of the sheathing so that the chips will split outward. If you make cuts against the sheathing, the ax may bind. Make cuts through a lath-and-plaster wall in a direction diagonal to the grain. After cutting the boards, use the pick end of the ax to pry and remove the boards.

FLOORS

8-24. In older buildings, wooden floors are laid double on joists, which are generally set on 16-inch centers. The subfloor is usually laid at a 45-degree

angle to the joists and the finish floor laid at right angles to the joists. To open these floors, cut through the subfloor and the finish floor. Both cuts should follow the side of the joists toward the inside of the required opening. In mobilization-type buildings, a single floor is laid directly on joists, which are set on 16-inch centers. Open single floors the same as flat roofs.

DOORS

8-25. Doors can be swinging, revolving, sliding, or overhead. Before using force, try the door. If the door is locked, examine it to determine the forcible-entry method to use. Wooden, swinging doors are panel, slab, or ledge. Doors in residential buildings usually open inward and doors in public buildings open outward. Slab doors are either hollow- or solid-core. Hollow-core doors are constructed of wooden strips formed into a grid or mesh. Solid-core doors are constructed of solid material. The core can be either tongue-and-groove blocks or boards glued in the frame or a fire-resistant, compressed mineral substance.

DOOR LOCK AND FASTENER

8-26. On a swinging door, the lock is a bolt (bar) that protrudes from the door to the fastener (metal keeper), which is part of a door jamb. The bolt may be part of the lock assembly or it may be separate. Use forcible entry to spring the jamb so that the bolt passes the keeper. Outside doors in barracks, store buildings, and recreation halls are set either against stops in the frame or against a rabbeted shoulder in the door jamb. Insert the wedge of a door opener just above or below the lock to gain entry. Use a spanner wrench with a wedge end when leverage is not a problem.

FORCIBLE ENTRY

8-27. You can use forcible entry to open roofs, floors, skylights, partitions, walls, and locked doors and windows. You must know how the building is constructed to determine the best places for forcible entry. Practice handling and using forcible-entry tools to ensure safety during an operation.

DOORS

8-28. Before using forcible entry to open a door, determine how the door hangs on the frame and how the door locks. Locks are either surface or mortised and can be pried until they spring free. Usually, the best method for opening these locks is to remove the hinge pins from the hinge with an ax or a spanner wrench.

Overhead Doors

8-29. Forcible entry on steel, overhead, rolling doors is difficult. These doors can only be opened by operating the gears and chain. Prying may spring the doors so that the gears will not function. Some doors have glass windows. Break a section of the glass to reach the latch and raise the door. On overhead lift doors, pry upward from the bottom of the door using a crowbar or claw tool. After the lock bar breaks, the door opens.

Stopped-Frame Doors

8-30. On these doors, raise the stop with a sharp wedge and swing the door clear of the fastener. When using a door opener, separate the lock and the jamb so that the lock passes the keeper.

Rabbeted-Frame Doors

8-31. Method 1: Split the jamb or break the lock bolt with a door opener. Insert the opener and push the door inward. Method 2: Insert a wedge above or below the lock and pry the door until the bolt passes the keeper. The door and jamb will be slightly damaged, but the door will close.

Double Doors

8-32. Open double doors by prying between the doors until the bolt clears the keeper. If an astragal or wooden molding covers the opening, remove it before inserting the wedge. Many double warehouse doors are secured with a bar that is dropped in the stirrups, which are located on the inside of the wall. Use forcible entry by battering down the door. On brick walls, batter a large hole through the wall and crawl through the hole and unlock the doors. This method is usually the quickest and least destructive entry method.

Latched Doors

8-33. Night latches will normally yield to the same prying tactics as mortised locks. However, if night latches are fastened to the door with screws, remove the locks by hitting them with a heavy object, such as a battering ram. When a battering ram is not available, push your shoulder against the side of the door opposite the hinges to spring the lock.

Single-Hinged Doors

8-34. On single-hinged doors locked with a hasp and padlock, such as those on sheds and stables, use a door opener to pry or twist off the hasp staple.

Fire Doors

8-35. These doors are mainly used to protect openings in division walls of vertical shafts. On fire doors that close automatically, pry open the doors using forcible-entry tools. On fire doors with exterior openings, force the lock by prying between the jamb and lock. Block the open fire doors to prevent cutting off the water supply in a hose line or trapping yourself in the building.

WINDOWS

8-36. A working knowledge of the various types of windows is necessary to effect successful forcible entry with minimal damage. This is only possible by becoming familiar with the types of windows used in your AO and learning how they operate.

Factory-Type Windows

8-37. These windows consist of steel sashes that are often set in the frame so that only a portion of the window can open. The movable portion is either pivoted at the center or hinged at the top and latched on the inside. Factory-type windows have small panes. Breaking the glass near the latches is the fastest, simplest entry method.

Check-Rail Windows

8-38. These windows have two frames (sashes) that are in contact at the top and bottom horizontals. If the window has no weights, the sash locks either with bolts in the window stiles or with a friction lock pressing against the window jamb. Open these windows by prying upward on the lower sash rail. If the window is locked on the check rail, the screws of the lock give way and the sashes separate. When the window is locked with spring-activated bolts, break or bend the sash before raising the sash. Pry the window where the lock is located.

Basement Windows

8-39. Open these windows the same as a door in a rabbeted frame. If you pry at the center of the lower rail, you can pull or spring the lock.

Casement Windows

8-40. Open these windows the same as double doors. When these windows are locked, break the glass to enter. Wooden casement sashes are generally hinged at the top and locked at the bottom or top. In some instances, breaking the glass causes less damage than other entry methods. If you follow the procedure below, the glass falls down away from your hands and to your side.

- Use an ax, crowbar, or pike pole.
- Stand to the windward side of the glass pane that you intend to break, if possible.
- Strike the top of the pane.
- Keep your hands above the point of impact.

CEILINGS

8-41. Use a pike pole to open plastered ceilings. Break the plaster and pull off the laths (Figure 8-5). Pull the metal and composition ceilings from the joists. Board ceilings are difficult to remove because the lumber resists when you jam a pole between the boards.

WALLS

8-42. Wooden-framed walls are constructed of wooden or fiberboard sheathing that is nailed over studs. The exterior siding, which may be wooden clapboard, board and batten siding, stucco, or other exterior finishes, is fastened over the sheathing. Open these walls as you would floors and roofs. Metal walls are metal sheets that are either fastened to wood or metal studs with bolts, screws, or rivets or are welded to metal studs. Use a breach-entry method.

FENCE LOCKS

8-43. Wood, metal, masonry, or woven-wire fences usually have gates that are locked with padlocks and hasps. Either pull these locks apart, using a claw tool, or cut the locks, using a cutting tool.

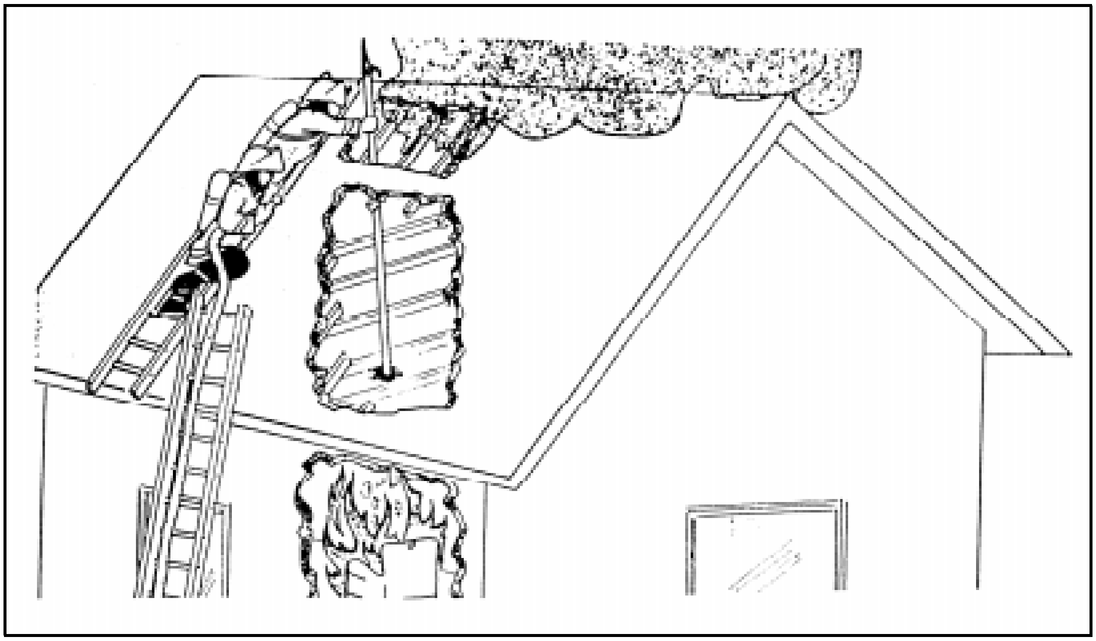


Figure 8-5. Opening a plastered ceiling

SAFETY PRECAUTIONS

8-44. The following are some of the safety precautions and procedures you should use during forcible-entry operations:

- Try opening a door or window before prying it.
- Carry your tools safely.
- Watch for explosive materials.
- Block open a door or window after entering, if possible.
- Place your tools in a safe place to avoid tripping.
- Stand to the side when breaking the glass; remove all jagged pieces.
- Block all overhead doors (up position) after entering.
- Be aware of obstructions and bystanders when using an ax; keep the area clear whenever possible.
- Watch for electrical wires and pipes when opening walls and ceilings.
- Make one large opening rather than several small ones.

VENTILATION

8-45. Ventilation is the systematic removal of smoke, heat, and toxic gases from a structure and the replacement of these gases with cooler air. Ventilating an area makes rescue and fire-fighting operations safer. In rescue operations, a ventilated area decreases the danger for trapped occupants

because the hot, toxic gases are channeled out of the structure. In fire-fighting operations, a ventilated area increases the fire crew's visibility and makes the working area more bearable. After fire crews properly ventilate an area, they can enter the area and locate and extinguish the seat of the fire. Proper ventilation usually reduces the chance of back draft.

8-46. An SFO decides when fire crews ventilate an area to avoid problems. If fire crews are not ready and told to ventilate, a fire could advance to a more difficult stage. If fire crews ventilate too late, a back draft could occur, causing extensive property damage, injury, or death. When a building is not immediately ventilated, the smoke and gases rise, spread, and fill the entire room or structure (mushrooming). When this occurs, fire crews must ventilate the area quickly before starting fire operations.

TYPES

8-47. The three basic methods of ventilation are horizontal (cross), vertical (top), and forced. The two subtypes of forced ventilation are mechanical and hydraulic. Vertical ventilation involves opening the structure directly above (or as close to) the seat of a fire as possible. Horizontal ventilation involves opening one side of the structure and then the opposite side (probably windows) to remove heated gases and smoke. Forced (mechanical) ventilation uses blowers or ejectors at a doorway or window to help remove the smoke and heated gases.

Horizontal

8-48. To cross ventilate, first open one side of the structure so that the heat and smoke can escape, and then open the other side so that the fresh air can enter the structure. Cross ventilation is more effective in certain types of structural fires than in others, such as the following:

- Residential buildings, when the attic is not on fire.
- Buildings with windows near the eaves.
- Attics of residential buildings with louver vents in the walls.
- Involved floors of multistoried structures.
- Buildings with large, unsupported open spaces under the roof. In this situation, a fire is not contained by fire curtains nor has the structure been weakened by the burning process.

8-49. You must consider wind conditions when cross ventilating. If there is no wind or if it is too windy, cross ventilation is not effective. Determine the wind direction and ventilate. First, open the top section of the windows on the leeward side to relieve the smoke and heat pressure. Second, open the lower section of the windows on the windward side to allow cool air to enter. Figure 8-6 shows horizontal ventilation.

8-50. Consider the interior and exterior building exposures when cross ventilating because you may have to route a fire. Be cautious; fire could spread from cross ventilating. Do not block the wind flow once you establish a cross-ventilation pattern. If the cool air flow is interrupted, hot air and gases could fill up the structure. If possible, avoid using an opening in the cross-ventilation pattern for applying a hose stream.

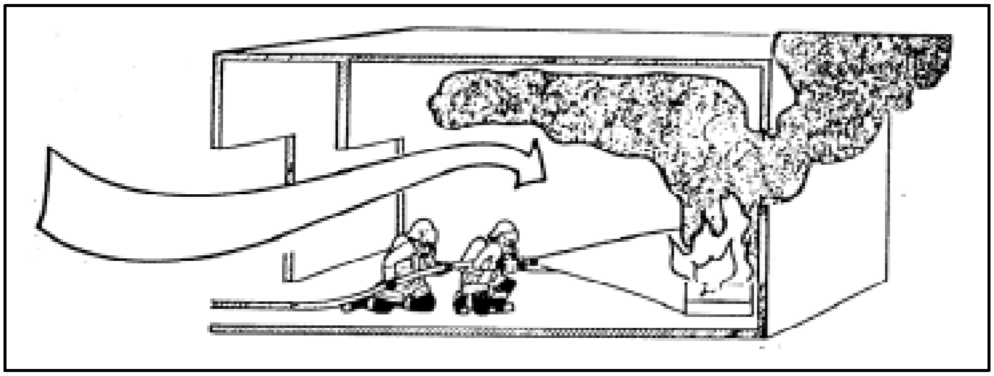


Figure 8-6. Horizontal ventilation

Vertical

8-51. Opening roofs is the primary method of top ventilation (Figure 8-7). To top ventilate, cut a hole in the roof above the seat of a fire. Hot air currents rise and remove the heat and gases. Before ventilating, consider—

- Coordinating your efforts with the ground and attack units.
- The wind direction.
- Obstructions or weight on the roof.
- Additional escape methods, such as a lifeline to the roof.
- Installed roof openings as a ventilation source.
- The size and number of the holes to cut.
- The condition of the structural supports.
- Possible accidents from opening.

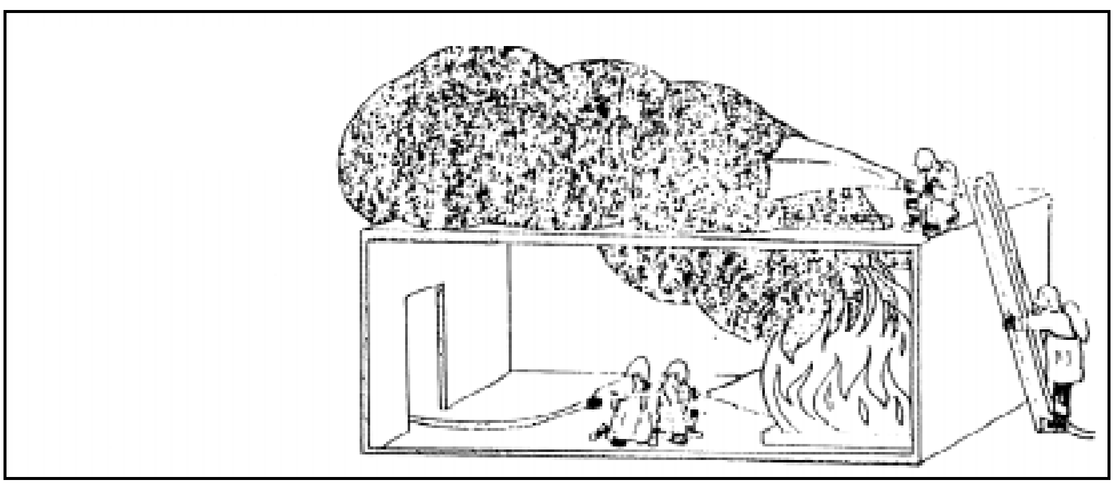


Figure 8-7. Top ventilation

Forced

8-52. Forced ventilation uses two removal techniques. Negative-pressure ventilation uses smoke ejectors to develop artificial circulation and pull the smoke out of a structure. The ejector is placed by a window, door, or roof vent. Positive-pressure ventilation uses a blower or smoke ejector to force air (at a doorway or window) into the structure creating a pressure differential. The higher pressure that is created inside the building forces the smoke through openings to the outside (area of lower pressure). The hydraulic technique uses a hand line with a fog pattern (at a door or window) to draw heat and smoke out of the building. In forced ventilation, mechanical blowers, fans, and fog streams move the air currents out of the structure.

Portable Machines

8-53. When using gasoline- or electric-powered, portable fans, locate them so that they will either pull out the smoke or force in fresh air. Place smoke ejectors at the highest level to draw out more heat. Seal a fan with curtains or drapes so the air cannot circulate around the fan and reduce its effectiveness.

Fog Streams

8-54. When using fog streams, fire crews must be inside the area that they are ventilating. The nozzle man will place the hose stream in an area at the top of the windowsill with just enough fog pattern to fill the window opening about 3/4 and hold the nozzle there. The smoke and heat will be drawn into the pattern and forced out of the structure.

COMMON ROOF TYPES AND OPENING TECHNIQUES

8-55. The more common roof types that a firefighter will encounter are listed below:

- Flat roof. To ventilate a flat roof—
  - Locate the roof supports.
  - Mark the roof area to be cut.
  - Use an ax to remove the built-up material or metal.
  - Cut the wood decking diagonally along the joist toward the center of the hole that you are making.
  - Use short strokes when chopping. If you use high strokes, clear the area and check for overhead obstructions.
  - Pry up the roof boards with the pick head of an ax. Use the blunt end of a pike pole, or similar tool, to knock through the ceiling.
  - Use power tools when necessary, such as a rotary-disc saw (K-12 saw) or chain saw, to speed up the operation.
- Pitched roof. To ventilate a pitched roof—
  - Determine where to make an opening, and place a roof ladder on either side of the opening. Use the ladder for support.
  - Remove the shingles or roofing felt.

— Cut the sheathing along each side of the rafters.

— Remove the sheathing boards with the pick of an ax.

— Use the blunt end of a pike pole to knock down the ceiling.

- Metal roof. To ventilate a metal roof, either pry up the metal sheets with a prying tool or cut the metal sheets with a cutting saw.
- Arch roof. To ventilate an arch roof, use the same procedures as for flat or pitched roofs. Roof ladders will be difficult to handle; use aerial or long, straight ladders.
- Installed roof openings. Be aware that a building can contain several types of roof openings: skylights, scuttle hatches, stairways, and ventilators (Figure 8-8). You can easily force most of these open without damaging the roof. If possible, use these openings to save time.

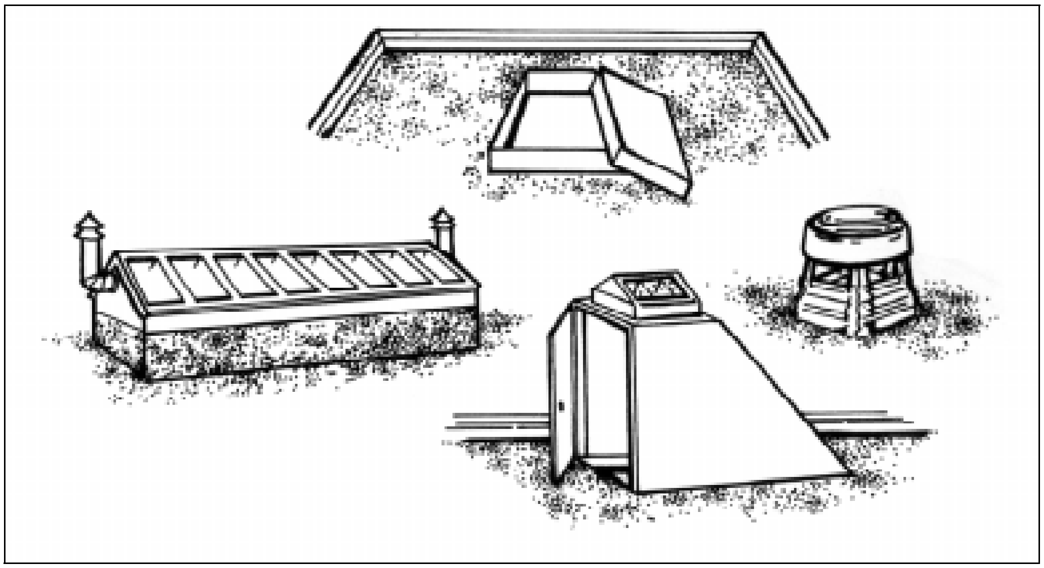


Figure 8-8. Roof openings

8-56. Do not disrupt top-ventilation patterns. With an opening in the roof of a structure, the natural convection of air currents expels the heat and gases. When this flow is interrupted, ventilation is ineffective. Do not direct a hose stream into ventilated openings. Heat and gases cannot escape. Direct hose streams above the horizontal plane of the opening to control hot embers and sparks. When deciding to ventilate, the SFO should—

- Ensure that the firefighters doing the ventilating wear full protective clothing and SCBA and that they stand on the windward side of the cut.
- Provide a secondary means of escape.
- Prevent personnel from walking on spongy roofs.
- Ensure that firefighters work from ladders to prevent slipping and sliding.

- Ensure that a hand line is positioned at the roof when the cut is made to provide protection to the firefighters on the roof.
- Ensure that the firefighters are cautious when using power tools.

LOCATION

8-57. The SFO should consider the following factors when determining a ventilation site:

- Availability of the installed roof openings.
- Location of a fire and the direction in which he wants the fire crews to draw the fire.
- Type of building construction.
- Wind direction.
- Extent of the fire and conditions of the structure and its contents.
- Bubbles or melting of roof tar.
- Indications of roof sag.

SECTION II. RESCUE

8-58. The primary function of rescue operations is to remove victims from inescapable places. A firefighter's first consideration is to save lives. He does this by removing victims from hazardous situations, carrying them to a safe place, and administering first aid. Rescue personnel must act cautiously when transporting victims to ensure that further injuries do not occur.

PROCEDURES

8-59. When performing rescue operations in a building, firefighters should—

- Always wear full protective clothing and SCBA.
- Not attempt rescue operations if the building is unsafe because of advanced fire conditions.
- Ventilate the building before entering it, if a back draft is possible.
- Work in pairs, when possible, and keep in contact with each other.
- Develop a plan and work from it to avoid becoming disoriented.
- Carry forcible-entry tools.
- Use a charged hose line when operating on the floor above a fire.
- Tie a rope to their body for safety when working in the dark or under extremely hazardous conditions.
- Remember the direction that they turned to enter a room. They should keep in contact with a wall while moving around and ventilate the area, if doing so will not enhance a fire.

- Exit a room by turning in the opposite direction from which they entered the room.
- Feel the doors before opening them. They should stand to one side, keep low, and open the door. If fire is behind the door, they should close the door to contain a fire temporarily so that they can continue searching. Once they complete a search, they should report their findings to the SFO.
- Stay low, move cautiously (Figure 8-9), and carry a hand light.

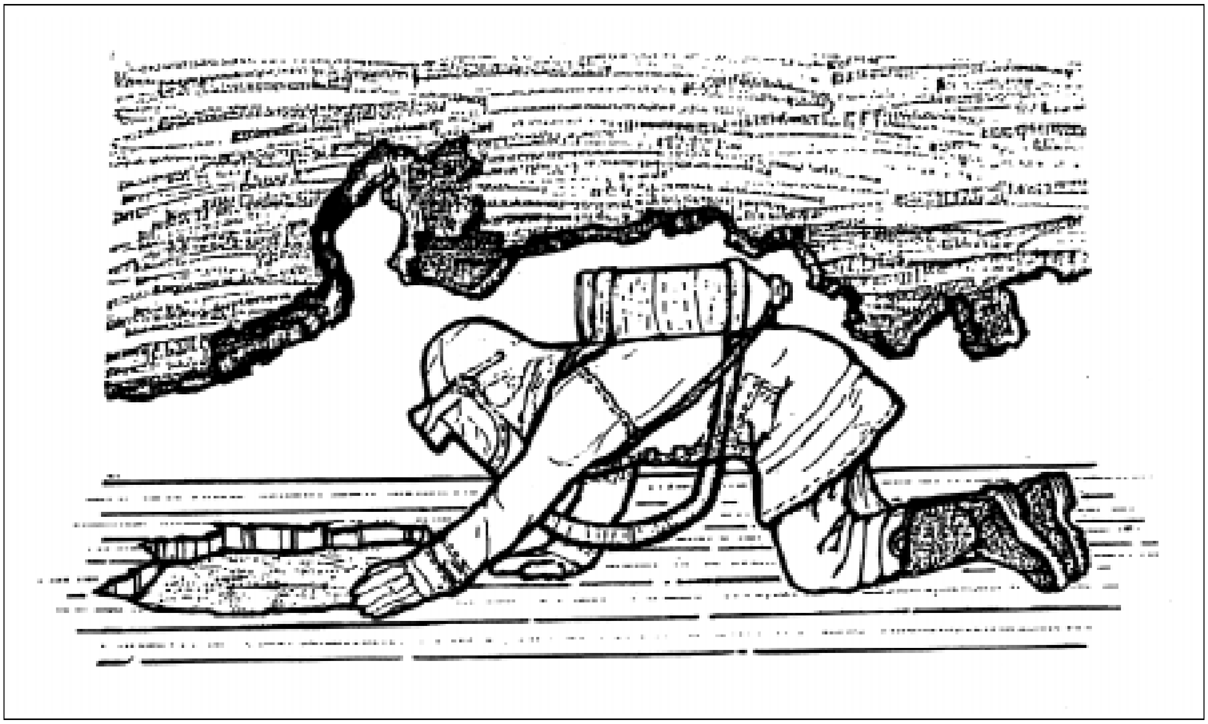


Figure 8-9. Rescue position

- Stay alert and use all their senses. Occasionally they should pause during the search and listen for signs or signals (moans, coughing, cries for help) from trapped victims.
- Watch for weakened structure or hot spots.
- Follow a wall if they lose their direction. If they see a hose line, they should crawl along the hose line; it will lead them to a nozzle man or outside.
- Follow a wall to the nearest window and signal for help if they become trapped. If they cannot find a window, they should stop momentarily and consider other escape actions.
- Push a door slowly, if it is initially difficult to open. A victim may be blocking the door. They should feel behind the door and check for a victim. They should not kick the door open.

SEARCH PATTERN

8-60. Your main consideration in a search is locating victims in relation to a fire. A primary search is a rapid search of the building to verify removal of all victims. A secondary search is a thorough search of a fire area after initial fire control. Always work in pairs when searching for victims. First check the fire floor and then the floor directly above the fire. If personnel are available, conduct rescue operations on both floors.

8-61. If multiple rooms or apartments lead into a center hallway, conduct a search in a series. Enter the first room and turn right or left to establish the search pattern. When exiting the room, turn in the same direction as you entered and continue searching. Always exit a room as you entered it to ensure a complete search. After searching a room, mark it as stated in your standing operating procedure (SOP). Doing so avoids duplicating efforts. If you abort a search or are removing a victim, exit the area by turning in the opposite direction from which you entered the area.

SEARCH AND RESCUE

8-62. Whether searching a room or an entire building, use a systematic approach. Do not just go into an area and start a haphazard search. Evaluate each area quickly and start a search and rescue based on your evaluation.

ROOMS

8-63. After entering a room, follow the wall around the room. Keep low and feel ahead for obstacles or pitfalls. Reach out with your hand or foot to cover a greater area. Keep in constant and direct contact with the wall. This method brings you back to your entry point (Figure 8-10). Search the center of the room (Figure 8-11).

8-64. Search all areas: behind the furniture; inside the closets, toy chests, and bathrooms; and on top of and underneath the beds. Follow the search pattern to avoid overlooking any area. Flip a mattress into a *U*-shape, indicating that you have searched the room.

COLLAPSED BUILDINGS

8-65. A building's condition determines the difficulty that you will have in rescuing victims. First, rescue the victims whom you can easily reach so that they can receive medical attention. Second, rescue victims who are in areas that are difficult and require more time to reach.

8-66. When the floor supports fail in any building, the floors and roofs may drop in large sections, causing the floors and roofs of the lower levels to collapse (pancake collapse, Figure 8-12, page 8-20). When heavy loads of furniture and equipment are located near the center of a floor, the excess weight may cause the floor to collapse. Figure 8-13, page 8-20, shows a *V*-type collapse.

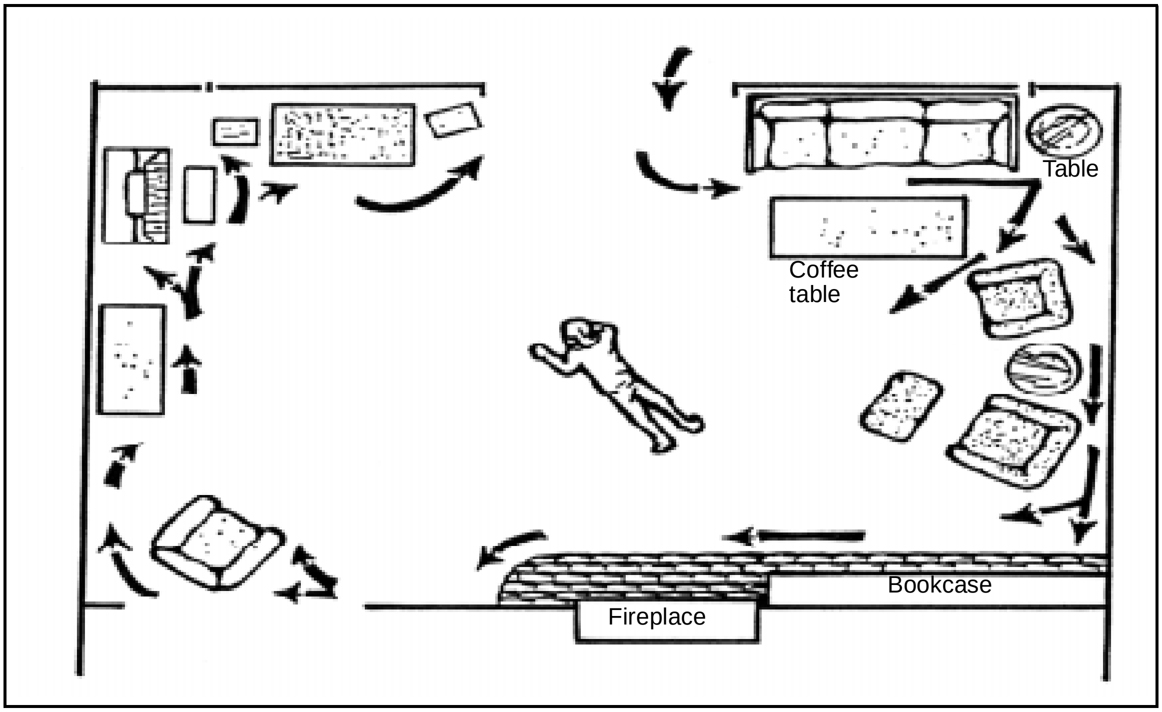


Figure 8-10. Searching a room's perimeter

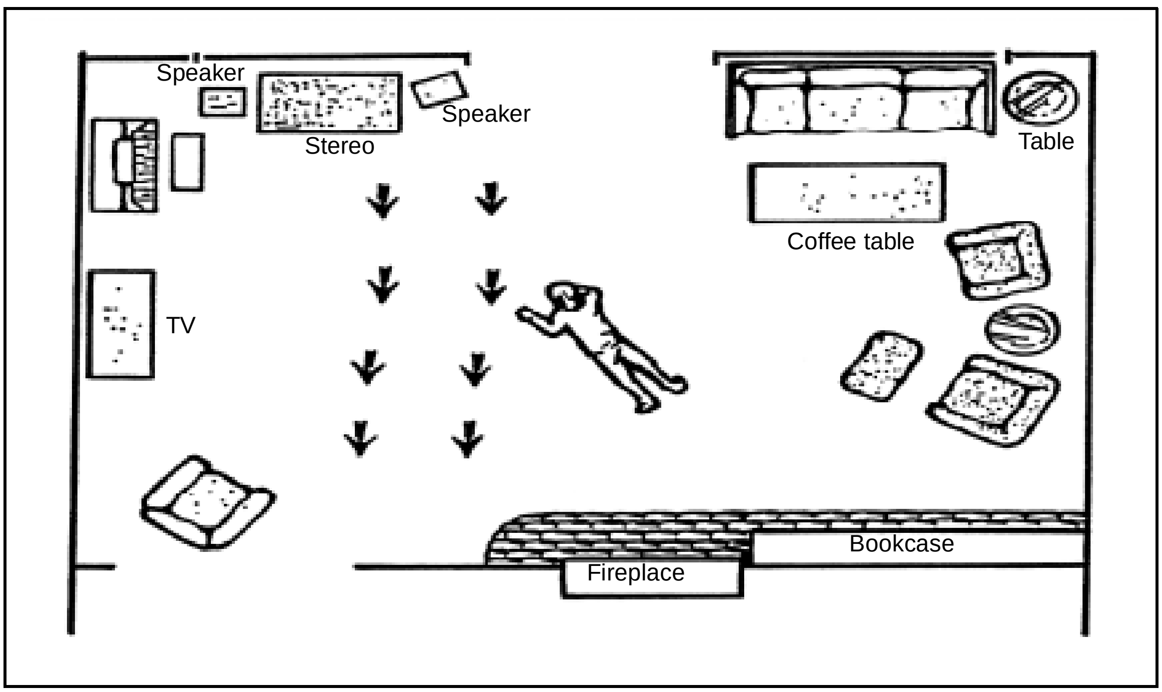


Figure 8-11. Searching the center of a room

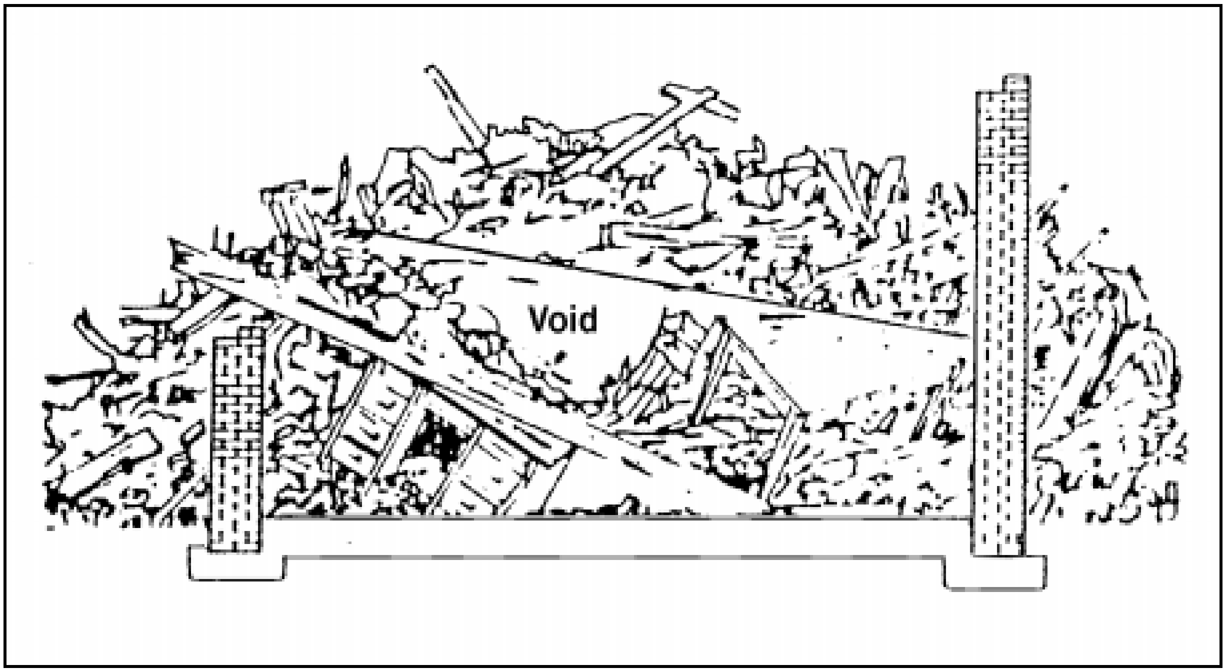


Figure 8-12. Pancake collapse

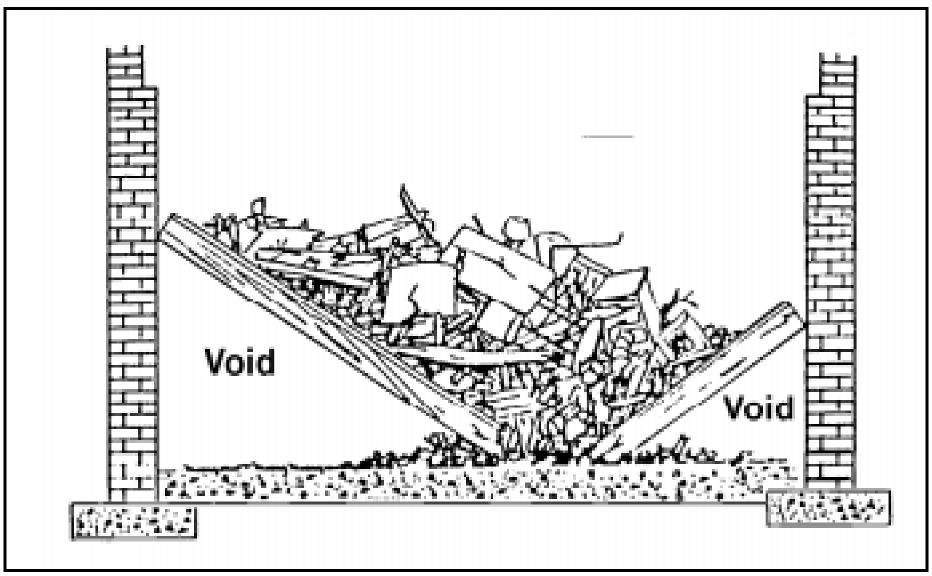


Figure 8-13. V-type collapse

8-67. To reach a buried or trapped victim, you may have to dig a tunnel. Tunneling is a slow, dangerous process. Try other rescue methods before tunneling. Do not dig tunnels to conduct a general search of an area. However, you can use tunnels to reach a void under a floor to continue a search. The following lists some tunneling procedures:

- Start a tunnel at the lowest level possible.
- Dig the tunnels large enough to accommodate the firefighters and victims.
- Do not construct the tunnels with abrupt turns.
- Drive the tunnels along a wall when possible. Doing so simplifies the framing required to prevent cave-in.

CAVE-INS

8-68. Use either shoring or cribbing to hold back weakened earth formations in a building or to secure tunnel openings and passages. Shoring is a series of timbers or jacks used to strengthen a wall or prevent collapse of a building or earth opening. Cribbing is usually adapted to roof and ceiling supports, but it can be used on walls.

8-69. Do not force beams, floor sections, or walls back into place. This action may cause further collapse and damage. When removing debris, watch for timbers or rocks that hold up other portions of earth or debris. Moving these pieces could cause a collapse or slide. Leave the timbers or rocks in place.

ELECTRICAL CONTACT

8-70. If a victim is in contact with electrical wires, do not touch the victim or the wire until the victim is clear of the wire. If the victim is not free from the wire or the wire will not endanger you, use a pike pole (made of a nonconductive material) to rescue the victim. Hook the victim's clothing and drag the victim clear of the wire.

VEHICLES

8-71. To rescue victims from vehicles, you must know basics about motor-vehicle design, hand and power tools, and patient care. You must also be prepared to face victims who are badly burned, mortally injured, or hysterical.

Safety Considerations

8-72. Observe safety precautions during an operation. Wear complete turnout gear during the operation. The following lists hazards resulting from vehicle accidents:

- Fire and its products.
- Glass fragments.
- Sharp metal edges on vehicles.
- Flying glass and metal.
- Dangerous chemicals and radiation.

- Tool failure.
- Unstable vehicles.

Assessment

8-73. An alarm-room operator must obtain as much information about a vehicle emergency as possible. He should record the—

- Location of the accident.
- Number and types of vehicles involved.
- Number of people injured and the types of injuries.
- Information on any special hazards at the scene.
- Name of the person calling and the call-back number.

Stabilization and Access

8-74. If a vehicle is on its side or upside down in a gully or on a hillside, do not rock or push the vehicle. Stabilize any vehicles that are in such difficult positions. Use jacks, wedges or cribbing, or come-alongs. In emergencies, use the bumper jacks or ropes or open the trunk lid and hood. Do not tip a vehicle if victims are trapped inside.

8-75. Choose the easiest route available to gain access to a victim. Try opening the doors. If they are jammed, break a window. If any window is broken in the accident and the frame is not bent, remove a victim through that window. If not, break the rear window. This window provides a large opening, and glass should not fall on the victim as readily as from a side window. The primary objective is to gain access and stabilize and protect the victim from further injury from sparks, glass, metal, and extrication tools.

8-76. After accessing the vehicle, stabilize the victim. Try to identify any life-threatening injuries, and administer first aid when necessary. Vehicle parts (steering wheel, seats, pedals, dashboard) often trap a victim. Free the victim from any vehicle parts and treat his injuries. The following is a checklist covering injuries and treatment:

- Watch for breathing problems. Open an airway, when necessary.
- Perform cardiopulmonary resuscitation (CPR).
- Treat for shock.
- Control the bleeding.
- Immobilize the victims that have fractures or spinal-cord, neck, and back injuries.
- Position the victims according to sustained injury.
- Strap the victims in securely.

VICTIM CARE AND REMOVAL

8-77. If the situation and time permit, carefully try to remove all the victims from an incident. However, if a fire, an explosion, or some other danger is

imminent, use whatever method you can to remove the victims and yourself from the area immediately.

CARRIES

8-78. If a victim cannot walk or has severe injuries, carry him. Use any of the following carries that is appropriate for the situation:

- One-man-supporting carry. Use this method if a victim is in the prone position. Assist him to a sitting position and then to his feet. Grab one arm, place it over your shoulder, and secure his arm by holding his wrist. Place your other arm around his waist and help him walk.
- Two-man-supporting carry. This method is similar to the one-man method except that the victim puts an arm over a shoulder of each firefighter. Each firefighter secures the victim's arm by grabbing his wrist. Firefighters place their other arm around his waist for support.
- Lone-rescue carry. If you have difficulty raising a victim to carry him—
  - — Place the victim on his back.
  - — Push his feet close to his buttocks and hold his feet in place with your foot.
  - — Grab the victim's hands and rock him up and down several times.
  - — Jerk him up, at the top of the upswing, and onto your shoulder.
- Fireman's carry. To execute this carry—
  - — Kneel on one knee near the victim's head and turn his face down. Place both hands under his armpits and gradually work your hands down the side and across his back.
  - — Raise the victim to his knees.
  - — Take a firm hold across his back.
  - — Hold the victim around his waist with your right arm, grab his right wrist with your left hand, and draw his arm over your head. (Change sides if the victim is wounded on the right side.)
  - — Bend at the waist and knees, and pull the victim's right arm down over your left shoulder so that his body comes across your shoulders. At the same time, pass your right arm between his legs and grab his right knee with your right hand.
  - — Lift the victim as you straighten up.
  - — Grab the victim's right wrist with your right hand.

- Two-firefighter carry. In this method, two firefighters form a chair with their arms to carry a victim. To execute this carry—
  - Each firefighter kneels on one side of the victim, near his hips, and raises him to a sitting position, supporting him by placing an arm around his back.
  - Each firefighter slips his free arm under the victim's thighs and clasps each other's wrist.
  - The firefighters rise slowly and lift the victim from the ground. When erect, they adjust their upper arms to form a comfortable back rest to secure the victim. If he is conscious, the firefighters should tell him to place his arms around their necks.
- Chair carry. In this method, two firefighters carry a victim in a chair. To execute this carry—
  - The firefighters should place the victim on his back.
  - One firefighter grabs the legs of the victim and raises his legs, buttocks, and back. The other firefighter slips the chair under the victim.
  - One firefighter is in front and one is in back of the chair. They grab the chair, tip it to a 45-degree angle, and walk forward.
- Extremities carry. This is a good carry method when a victim is conscious or unconscious and does not have leg or back injuries. Two firefighters execute this carry. To do so, the—
  - Firefighters lay the victim on his back with his feet apart. They face each other, one standing between the victim's legs and the other at the victim's head. They kneel and raise the victim to a sitting position.
  - Firefighter at the victim's head grabs him from behind, placing his arms around the victim's body under the armpits.
  - Firefighter standing between the victim's legs turns around and grabs the victim's knees.
  - Firefighters rise and carry the victim.
- Severe-injuries carry. If a victim is severely injured, at least three firefighters should carry the victim. To execute this carry, the—
  - Firefighters must designate one person to be the leader who will give the commands.
  - Firefighters stand on one side of the victim.
  - Leader gives the command *prepare to lift*.
  - Firefighters kneel on the knee nearest the victim's feet: one firefighter at the victim's shoulders, one at his hips, and one at his knees.

- Firefighters place their hands and forearms under the victim's neck and shoulders; pelvis, hips, and small of the back; and knees and ankles.
- Firefighters, at the command *lift*, raise the victim and place him on their knees.
- Firefighters, at the command *prepare to raise,* slowly turn the victim on his side toward them until he rests in the bend of their elbows.
- Firefighters, at the command *rise*, slowly rise to a standing position, holding the victim close against their chests.
- Leader gives the command *march*, if the firefighters can move forward, and all lead off on the left foot. If they must move sideways, the leader gives the command *side step left (or right),* and all lead off with the foot the leader commands.
- Firefighters reverse the operation to lower the victim, at the command of the leader.

OTHER REMOVAL METHODS

Dragging

8-79. Drag a victim when only one firefighter is available and speed is important. To drag a victim—

- Roll him onto a coat, blanket, or similar object.
- Grab the object on each side of his head; lift him so that his head and shoulders are off the ground.
- Drag him to safety.

Using a Stretcher

8-80. Use the same procedure for placing a victim on a stretcher as for preparing to lift in a severe-injuries carry.

Using a Ladder

8-81. Use a ladder as an escape means when a victim is trapped on a floor above ground level. If he is conscious, descend the ladder first. Keep your arms around him and one knee between his legs for support. To rescue an unconscious victim—

- Raise a ladder just above the window where you are making the rescue.
- Pass a lifeline underneath the bottom rung so that the rope feeds from the underside of the ladder.
- Thread the rope up and over three consecutive rungs when you reach the bottom of the windowsill.
- Feed about 20 feet of rope through the window. A ground crew will assist in feeding the rope.

- Step into the room, tie the rope around the victim, and assist him onto the window. The ground crew will help lower the victim to the ground.
- Use a stokes basket to lower a victim if he has severe injuries. Lace him inside the stokes and lower him to the ground.

SECTION III. CONTROL AND EXTINGUISHMENT

8-82. Rescuing victims is the primary concern of any fire operation. The secondary concerns are fire control and extinguishment and related procedures essential to preserving property. Before starting extinguishing operations, fire crews must consider the type, quantity, and locations of the materials in the building.

LOCATING A FIRE

8-83. Structural fires generally fall into two categories, interior and exterior. Both involve the same basic materials but in different conditions, quantities, and proportions. Fire crews can often observe an interior structural fire through open doors or windows; sometimes they must enter the structure to locate a fire. A red or orange glow usually indicates the presence or location of a fire.

INTERIOR FIRES

8-84. These fires normally involve excessive smoke and ventilation problems, back-draft possibilities, and difficulty in locating the fire. Fire crews must anticipate suffocation possibilities for themselves and building occupants. Interior fires do not threaten adjacent buildings unless the roof or walls of the burning building collapse. A delay in controlling a fire, rekindling before fire crews arrive, or widespread smoldering before ventilation could cause the building to collapse. Fire crews should not use a hose line inside the building until they see a fire or if they need a fog curtain to reach the seat of a fire.

EXTERIOR FIRES

8-85. Fires outside of a building could start from various causes (discarded cigarettes or embers falling on rooftops). Also, an exterior fire could result from an interior fire burning through the roof or outside walls. A fire crew's main objective is to prevent a fire from spreading to other buildings.

CONFINING A FIRE

8-86. After locating a fire, try to confine it to its point of origin. Cover the internal exposures with hose streams, and shut the external doors and windows to localize a fire. The leeward side of a fire is the most difficult to approach. The wind carries the heat and smoke toward the fire crews. However, the leeward side is a good place to make a fire stop and prevent a fire from intensifying and spreading.

8-87. Attack a fire from as many sides as possible. Use proper ladder work and ventilation procedures when locating, confining, and closing in on a fire. If there is a danger of back draft, position and charge hose lines before opening them. Watch for heavy smoke escaping from cracks around doors or beneath

eaves. This is a sign of back draft. Close in on a fire as conditions permit. Do not advance hose lines too quickly; a fire could rekindle and spread. When using extinguishing agents on Class B fires, back up the agents using a water-fog line or a foam line. This precaution guards against a flashback of Class B materials.

8-88. Walk cautiously when working in dark areas or on weakened floor supports. Crawl on your hands and knees, if necessary. If large cracks appear in masonry walls, leave the area immediately. When advancing a hose line in radiated heat, use the helmet shield to protect the face piece of the air pack. The nozzle man receives the impact of a fire's heat, so rotate the firefighter at this position to ensure that each person rests and cools off. If you must retreat from a forward position, follow a hose line back to safety.

SECTION IV. SALVAGE AND OVERHAUL

8-89. Salvage is the prevention of excessive fire, smoke, and water damage. Firefighters move material either outside the burning building or to an area not involved in a fire. The amount of salvage work firefighters must do depends on the amount of salvage equipment available, the number of personnel available, the type and amount of material involved in a fire, and the storage method of the material. Overhaul is the complete check of all structures involved in a fire. Firefighters look for hidden fires, ensure that all sparks and embers are extinguished, and look for and protect the area containing the cause of a fire.

PROTECTION PROCEDURES

8-90. You can cause excessive damage to stored material if you use large amounts of water to extinguish a fire or improperly apply water, such as using a straight stream instead of a water fog. Cover the material stored on lower floors with large tarpaulins. If possible, move the material outside or to an area in the building not involved in a fire. Cover heavy crates, packing cases, machinery, and similar articles. Wipe dry and oil all metal. Protect food items from smoke and water exposure.

8-91. To prevent excessive water damage, apply water to the base of a fire. Watch for leaky hose connections. Do not spray water on dry material. Do not over spray absorbent-type materials. The excess weight could collapse the floors. After extinguishing a fire, use sawdust to absorb the water and to form barriers so that you can direct the water through doorways or other openings. If necessary, drill holes in the wooden floors for drainage.

8-92. Remove valuable items as soon as you extinguish a fire. Remove debris from the building; sweep the floors; and remove excess water with brooms, squeegees, and water vacuums. In administrative, HQ, and other office buildings, cover the records and files with canvas covers and secure the records. If a roof has been damaged, cover the hole with a tarpaulin or roofing paper. If the roof is destroyed, the post engineers should install temporary roofs of canvas truck covers.

SALVAGE COVERS

8-93. Salvage covers have a number of functions. They are used to cover furniture and carpet and are used as carpet runners and catch basins to divert water outside the structure during and/or after fire-fighting operations are completed. If used in a timely manner, salvage covers can save valuable property and prevent unnecessary smoke and water damage.

TYPES

8-94. Conventional salvage covers are made from closely woven, waterproof canvas materials. The covers have reinforced corners and hems with grommets for hanging or draping the covers. Newer covers are made of polyethylene plastic and are lightweight. They are not affected by alkalines, oils, acids, caustics, or solvents. These covers remain flexible in subzero temperatures; will not mold, mildew, or absorb moisture; and are not affected by abnormal temperatures.

MAINTENANCE

8-95. Clean salvage covers by spraying them, scrubbing them with detergent, and rinsing them thoroughly. Examine the covers for damages after they are dry. Make sure that the covers are completely dry before folding and placing them in service. To roll a salvage cover, bring the ends together in the center of the cover. Continue this process to the desired width. Complete the operation by rolling the cover.

THROWS AND SPREADS

8-96. The most common type of salvage-cover throws are the one-man throw, the two-man spread, the counter payoff, and the catch basin. What needs to be covered and how much manpower is available will determine the method used.

- One-man throw. Use the following procedures to throw and spread a 12- by 14-foot salvage cover:
  - — Place the center of the folded cover over your forearm and grab the bottom of the fold.
  - — Grab the three folds, with your other hand, between the thumb and fingers, thumb down.
  - — Swing your arm up and over your shoulder and place the three folds over the back of your hand to give weight to the throw. Bring your hand forward and throw the cover over the object with a straight-arm throw.
  - — Open the cover and tuck the edges in at the bottom.
- Two-man spread. Two firefighters should use the following procedures to carry and spread a 14- by 18-foot salvage cover:
  - — One firefighter carries the cover. He grabs the grommet ropes at the corners nearest his body. The second firefighter grabs the remaining ropes and moves away from the first fire-fighter.

— Both firefighters drop the cover and stretch it out near the material to be covered. They drop the inside edge of the cover while holding the outside edge.

— The firefighters raise the outside edge and cover the material, allowing the air to balloon the cover. This ensures correct placement. They should tuck all corners and edges in at the bottom.

- Counter payoff. Use this method to cover material to prevent damage, destruction, or disarrangement of the material. This method requires two firefighters. One firefighter holds the cover by the bottom fold. The second firefighter grabs the top fold and walks backward. Both firefighters raise the cover as it unfolds and place it over the material. They tuck in the cover's edges at the bottom.

- Catch basin. To catch large amounts of water dripping through a floor or ceiling, use a salvage cover to construct a deep catch basin. Place furniture, boxes, or other items in a circle or square beneath the leak (Figure 8-14). Spread the salvage cover over the framework, tuck in the loose edges, and tie the cover to the items. To catch small amounts of water, use a salvage cover to construct a shallow basin. Roll two sides of the cover in about 5 feet. Roll the other sides in about 1 foot. Lift the corners in and tuck under to lock the corners.

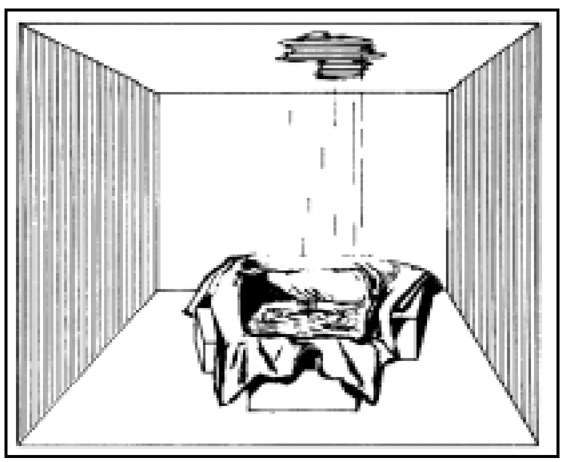


Figure 8-14. Catch basin

- Water chute. Use a water chute to drain water from a ceiling to the windows or doors. Spread a salvage cover over two pike poles and roll the poles toward the center to form the chute. The water's weight will tighten the rolls (Figure 8-15, page 8-30). An alternate method of constructing a water chute is by using *S*-hooks, cord, salvage covers, and pike poles. You can tie light rope or heavy cord through the grommets to support the covers. To protect interior structures and contents from water damage, use canvas covers as stairway drains to

direct the water from upper floors to a lower level and outside. Figure 8-16 shows how to form a chute on a stairway.

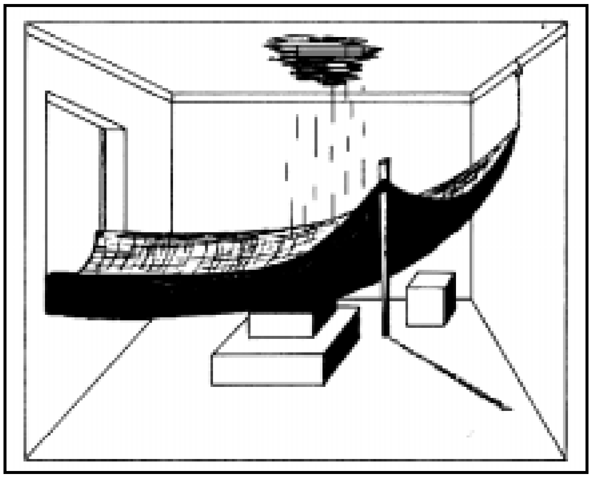


Figure 8-15. Spreading a salvage cover

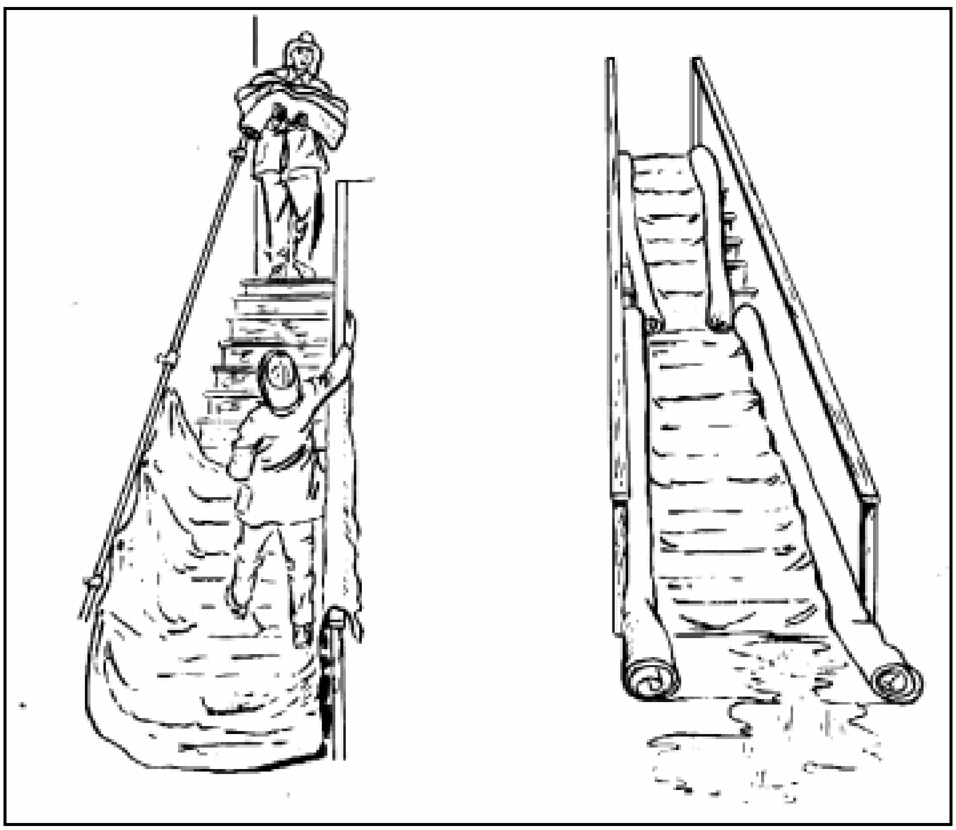


Figure 8-16. Forming a chute on a stairway

OVERHAUL

8-97. During this operation, check the entire structure to ensure that hidden fires or embers do not cause reignition. The salvage methods you execute during an operation will affect any required overhaul work.

STRUCTURAL CONDITIONS

8-98. Before searching for hidden fires, determine the building's structural condition. Check for weakened floors, spalled concrete, weakened steel roof members, offset walls, opened mortar in wall joints, and melted wall ties. Cover or block off holes that have been burned or cut in the floor. Block off approaches to damaged stairways or elevator shafts. Pull down walls or chimneys that are weak and possibly dangerous.

HIDDEN FIRES

8-99. You can detect hidden fires by sight, touch, or sound. Look for discolored materials, peeling paint, or smoke emitting from cracks, cracked plaster, and dried wallpaper. Feel the walls and floors. Listen for popping, hissing, and crackling sounds. Carefully check the entire area to determine a fire's spread. If a fire spreads to other areas, determine its path. Check for hidden fires in—

- Floor beams. If the ends that enter a party wall are burned, flush water into the voids in the wall. Check the far side of the wall to see if fire or water has come through.
- Areas containing insulation. Remove insulation because it can hide fires for prolonged periods.
- Casings. If a fire has burned around windows or doors, open the casings and inspect for fire.
- Cornices. If a fire has burned around the roof, open the cornices and inspect for fire.
- Concealed spaces. Open the areas below floors, above ceilings, or within walls and partitions. Remove only enough material to check for hidden fires. Move any room item that could be damaged during overhaul operations. Do not overhaul weight-bearing members.

SECTION V. INVESTIGATION AND RETURN TO SERVICE

8-100. Investigating a fire involves looking for and safeguarding evidence that could determine the cause of a fire. This procedure could occur during control, extinguishment, and overhaul operations. If fire personnel suspect arson, they should inform fire investigators (LA team).

INITIAL INVESTIGATION

8-101. Take colored photographs of the entire fire scene. If arson is suspected, label items, such as gasoline cans, cotton trails, film trails, candles, oil-soaked rags, cleaning-fluid containers, matches, and cigarettes. Labels should include

the name of the person who found the item and where and when the item was found. Take notes on the following items:

- The number of people present when the fire personnel arrived.
- The number of fires burning when the fire personnel arrived.
- The color and aroma of the smoke.
- The color of the flame and from where it was coming.
- Where the doors were locked (inside or outside).
- The condition of the contents and if they were disarranged.
- The nature of the burning material.
- The wind direction, humidity, temperature, and general weather conditions.
- The direction of the fire's spread.
- The condition of the area where the fire may have started.
- The statements from observers who may have seen unusual occurrences before the fire broke out.

8-102. Make detailed sketches of the area. These sketches may be needed during a board of inquiry or investigation proceedings, especially if an arsonist is brought to trial.

8-103. If the fire building contained classified documents or equipment (reels of film, models drawings, files), the SFO should request that guards be posted over the area until the classified material is moved to a secure location. Since firefighters are not authorized to examine classified materials, they must be careful during salvage and overhaul operations. They should set aside classified items in a designated area for proper authorities to examine.

8-104. Before returning to the station, the SFO should gather all the facts necessary to complete the required fire-report form, Department of Defense (DD) Form 2324 or DD Form 2324-1. This report should include the—

- Type of alarm.
- Location of the fire.
- Building number.
- Description, origin, cause, and confinement of the fire.
- Property damage.
- HAZMATs (type, amount, path of released substances).
- Containment measures taken during and after fire-fighting operations.
- Agents used.
- Time required to extinguish the fire.
- Number of personnel near the burning structure.

- Mileage traveled.
- Weather.
- Remarks made by people around the burning structure.

ORIGIN OF A FIRE

8-105. In a serious fire (loss of life, extensive property damage), the fire marshal or another person from higher fire-department HQ may assist in the investigation as an impartial party. The investigators may collect more detailed information than required. The information may include the—

- Reasons for delay in the alarm.
- Extensive spread of the fire.
- Heavy property loss.
- Inability of occupants to escape.
- Fire-fighting methods used.
- Adequacy of the water supply.
- Correction of previously noted deficiencies.

8-106. In a less serious fire, the information recorded on the fire report is sufficient. However, until all evidence is examined, you may not accurately account for a fire's origin and cause and the damage estimates.

8-107. To locate a fire's origin, you may have to reconstruct the walls, replace the loose boards and doors, or rearrange the furniture. Obtain as much information as possible about the types of materials that were in an area. Examine the remains because they can indicate the direction of the heat flow. However, factors such as drafts can also affect a fire's spread and heat flow. The condition of metals, grass, wood, plastics, and other materials are good indications of the temperatures at certain spots.

WOOD

8-108. Char depth indicates the length of time that wood burned. Most woods will char at the rate of 1 inch per 40 to 45 minutes burn time at 1400 to 1600°F. Demarcation lines between charred and uncharred material are indicators of the type of heat involved. For example, if you chop or saw through charred boards located near a fire's origin, there should be sharp, distinct lines between charred and uncharred wood. This will occur if the fire was fast and intense and extinguished quickly. The wood will show a gradation of char and a flat, baked appearance throughout, if a fire was long and slow.

GLASS

8-109. Glass is composed principally of silicon and lime. Glass will soften at 1200° to 1400°F and will become molten above 1600°F. Examining the glass

can provide information as to how a fire's heat reacted on the glass or if other forces acted on the glass.

- Heat. The following explains how heat can react on glass:
  - Broken pieces from windows in clear, irregular, block-shaped pieces indicate a rapid, intense buildup of heat in a 1- to 5-minute time frame.
  - Heavily glazed pieces with little or no stain indicate an intense heat with a slow buildup.
  - Heavily stained pieces with no crazing indicate a slow buildup with considerable smoke. Half-moon checks on a stained side indicate that the glass was still in the frame during a fire and that water splashed on the glass.
  - Unstained or heat-checked pieces found on the floor indicate that the glass was broken by intense heat early in a fire.
- Other forces. The following lists reactions glass has from other forces:
  - Clear, long, rectangular pieces inside a building indicate that some other force (forced entry) broke the glass.
  - Radial cracks in glass emitting from the point of impact and concentric cracks around the point of impact indicate that the glass was broken by a blow from a hard object. The glass near the break comes out in rectangular- or triangular-shaped pieces.
  - Thermal cracks in glass have no pattern and pieces are odd-shaped.
  - High-intensity explosives (dynamite) cause glass to sliver.
  - Low-intensity explosives (dust or gas) cause glass to break off in chunks.

METAL

8-110. Most chromium or shiny metal surfaces, such as light fixtures, toasters, and irons, turn different colors when subjected to intense heat. The color variance could indicate the progress of a fire.

CAUSE OF A FIRE

8-111. When investigating the cause of a fire, first consider common causes, such as discarded cigarettes, overheated or defective stoves or flues, faulty electrical appliances, and slag or sparks from welding and cutting machines. If none are the cause of a fire, question all the people who are at the fire scene (mainly building occupants), the people who were present at the time of or immediately before the discovery of the fire, and the people who had left the building and may have returned. When investigating a fire's cause—

- Reconstruct all the areas as much as possible.
- Determine the heat path and the fire's point of origin.

- Determine the approximate burning time.
- Evaluate the combustion characteristics of the materials involved.
- Compare similar materials and situations, if possible.
- Fit the known facts to the various possibilities.
- Compare the information from the occupants and neighbors as to the activities before the fire.

8-112. Extensive investigations are required for high property-loss fires or those involving loss of life. Appointed officials, assisted by the fire marshal and appointed aides, usually conduct these investigations. Before moving or shoveling out any material, carefully examine the layers of material as you work to the floor. This method could show the sequence of materials burned from the point of origin. In a fire, aluminum and similar alloys will melt fairly early, splash or run on other materials, solidify at lower temperatures, and protect the material from further damage.

LOSS ESTIMATE

8-113. Loss estimates are calculated after you complete salvage operations. Inventory all remains and compare that list with a prefire inventory list. Loss includes damages from smoke, heat, water, and fire. Installation engineers often assist in estimating loss value. The fire chief examines the fire scene and writes a brief description of the extent of the physical damage.

8-114. On an installation, the organization that is responsible for construction contracts estimates partial losses of Army structures. Total structural loss is the structural value taken from a recent prefire real-property report. Because construction costs fluctuate, evaluators should make an estimate based on current restoration costs. Vehicle and aircraft losses will be determined by replacement in kind for partial losses and recorded inventory value less salvage for total losses.

8-115. When preparing a preliminary report, the fire chief should not go into detail in a loss estimate. If available, the fire chief should use the estimate that the evaluators provide. If the two estimates vary greatly, a further investigation may be necessary. Either party may have overlooked important evidence during their evaluation, which would account for a discrepancy.

FINAL ACTION

8-116. In large fire operations, the SFO must obtain as much information as possible, such as the names of witnesses, statements, photographs, a sketch of the building, and the location of apparatus and hose lines. Firefighters not involved in salvage and overhaul operations should return to the station. Crew chiefs should double check the area to ensure that all the equipment and tools are back on the fire apparatus. If a building occupant borrows fire equipment, the fire personnel must have a receipt for the equipment and leave instructions on returning the equipment.

8-117. Before leaving, reload hose lines in the bed of the fire truck in case an emergency occurs before returning to the fire station. If you used only a few sections, you may roll and stack the hose line on the tailgate.

RETURN TO QUARTERS

8-118. Once back at the station, the crew chief in charge reports on the status of his truck to the alarm-room operator. He also notifies the alarm-room operator when his truck is back in service. The fire chief or crew chief completes the required fire reports and makes entries in the daily log book. Firefighters—

- Check the fire apparatus.
- Wash the tires and inspect them for cuts, nails, and other damages.
- Check and resupply the fuel, oil, and water levels in the radiator and booster tank.
- Replace the used hose lines with clean, dry hose lines.
- Wash the dirty hose lines and place them on racks to dry.
- Roll clean, dry hose lines.
- Wash wet salvage covers, inspect them for cuts and tears, and hang them to dry.
- Inspect the ladders for damages.
- Clean and dry all dirty and wet tools and appliances.
- Apply a light coat of oil on the metal surfaces that might rust.
- Wash the entire fire apparatus to remove mud, dirt, and carbon.

8-119. After completing all clean-up operations, the crew chief or assistant chief should conduct a general discussion with all fire personnel involved in the operation. The crew chief should review the entire operation, pointing out negative and positive aspects of the firefighter's actions. Before conducting a general discussion, the crew chief should administer private reprimands as a means of correcting individuals who committed serious mistakes. If the entire crew needs improvement, the crew chief should conduct training sessions and drills. If an individual or the entire crew does exceptionally well, the crew chief should extend praise during the general discussion.

Chapter 9

Miscellaneous Facility-Based Fire-Fighting Operations

9-1. Miscellaneous fire fighting generally refers to any fire-fighting activity that does not involve structural or crash/rescue fire fighting. Tactical petroleum terminals (TPTs), logistics bases, internment/ dislocated civilian camps, and general support hospitals are some of the special mission areas that firefighters support. These infrequently encountered, vital missions probably require firefighters to focus even harder on training because they see so little of them.

TACTICAL PETROLEUM TERMINAL

MISSION

9-2. One of the major facilities that will require fire-fighting support in the AO will be the TPT. The mission of the fire-fighting team with a TPT in its AO will be to—

- Position organic fire-fighting teams.
- Conduct sustainment training of POL crews to use the organic fire-fighting equipment.
- Respond to all incidents involving the TPT.

SITE DESIGN

9-3. The TPT has organic fire-fighting equipment in its design, but the equipment is a first-response measure only. The fire-prevention section of the LA or the LB team will conduct an on-site inspection to ensure that the fire-fighting suppression sets have been placed in the most effective locations. The TPT personnel will inspect within their area to ensure that—

- Berms are properly placed around storage areas in case of leaks or spills.
- All leaks and spills are reported as required, to include the appropriate Army safety and environmental protection functional offices.
- The areas are spaced out to control the spread of fire.

TRAINING

9-4. Personnel assigned to a TPT will have little or no training on how to use fire-suppression equipment. Therefore, fire-fighting teams will have to train

key personnel at the terminal so that TPT personnel can perform in case of an emergency. Training will include—

- Putting the fire suppression sets into service.
- Conducting daily preventive maintenance checks and services (PMCS) of the set and their personal protective clothing.
- Using the sets effectively in an emergency.

ADDITIONAL SUPPORT

9-5. In any incident, the fire-fighting teams should respond to extinguish the fire and contain the vapors. They will also ensure that fire-suppression sets are reserviced and back in operation in a timely manner.

9-6. When responding to fires in a TPT, the fire-fighting teams must ensure that they do not cause more damage than the fire; therefore, prefire planning is important in a TPT. Networks of piping, valves, pumps, and storage bladders will be interconnected throughout the site. Special care should be noted for shut-off valves and response routes.

9-7. If a storage unit is fully involved and extinguishing the fire poses more of a threat because of vapors, the fire-fighting teams will protect the other storage areas and allow the fire to burn. Controlling runoff is very important in fighting a fire in a TPT. Firefighters must channel the runoff and control it to ensure proper cleanup after extinguishing the fire.

FIRE-SUPPRESSION EQUIPMENT

9-8. The basic load in a TPT will be 18 fire-suppression equipment sets. Table 9-1 lists the components of one set; Figure 9-1 shows one set. Each set must be inspected and placed in service, according to TM 10-4210-235-13, before a TPT can operate.

Table 9-1. Items in one fire-suppression equipment set

Number	Component
1	Trailer-mounted, twin-agent unit, 100-gallon AFFF, premixed/250-pound Purple K, 150-foot attack line
1	Auxiliary hose cart with additional 150-foot attack line
3	Set of aluminized protective gear, 1 each of small, medium, and large
5	20-pound, dry-chemical extinguisher
3	Complete recharges for twin-agent unit

9-9. The fire-suppression equipment sets are designed so that the POL handlers use them as a first response to a fire. Pre-positioning the sets is key to their successful use in an emergency. Once the sets are in place, they are considered fixed. The sets must be placed close enough to the danger areas (300 feet maximum for the attack line) but not in the immediate area to preclude their use. Each storage area should be accessible by at least two sets. Additional sets should be in loading and unloading areas where pumps are located. If possible, a free set should be available for hooking up to a vehicle and repositioned, as required, to support other fixed locations in case of an incident.

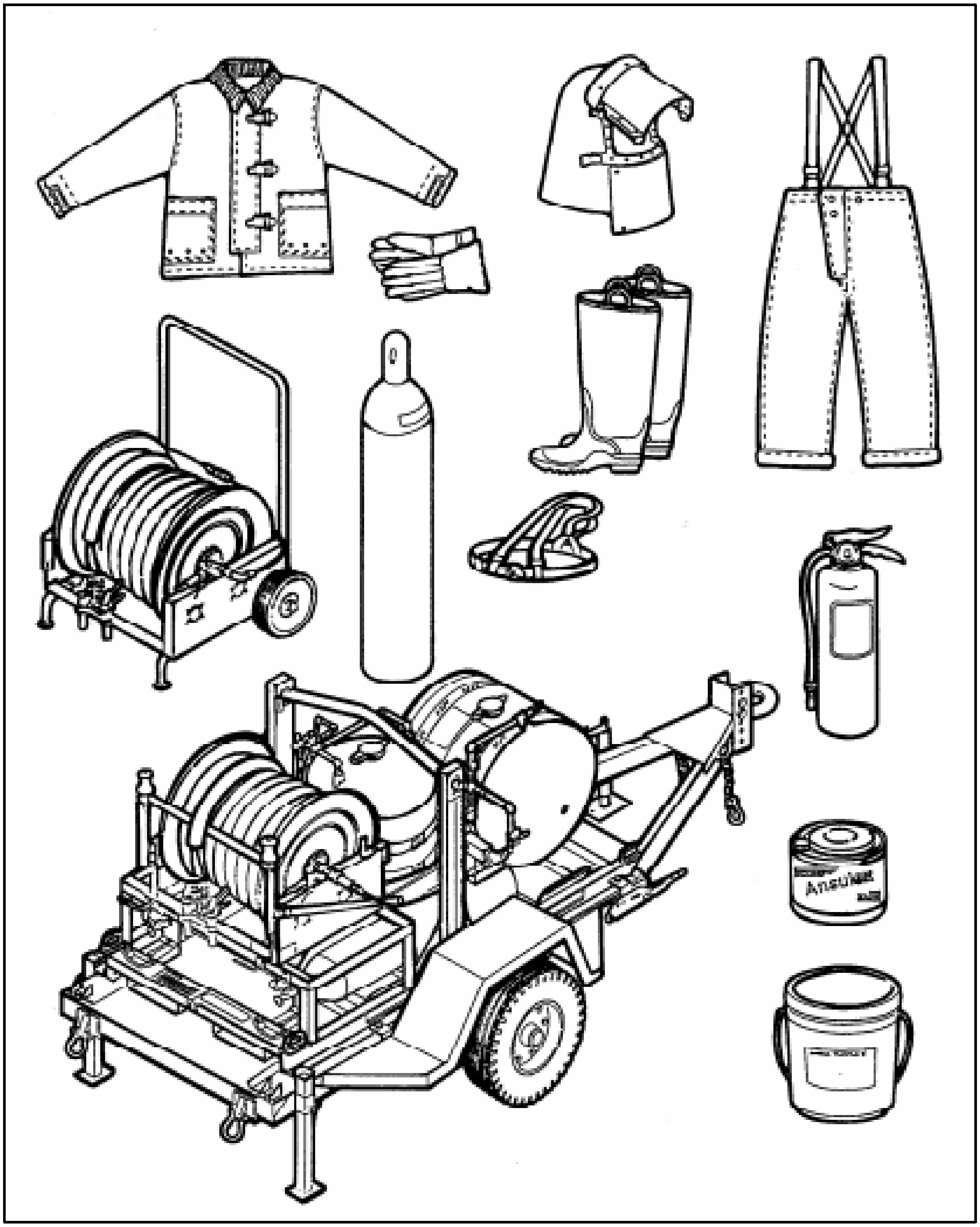


Figure 9-1. Fire-suppression equipment set

LOGISTICS BASE

9-10. Fire-fighting teams assigned to major logistics bases will be involved in emergencies involving internal and external storage, bulk POL products, HAZMAT storage, tent cities, vehicles, and personnel incidents. Their missions will include the following:

FIRE PROTECTION AND PREVENTION

9-11. Fire-fighting teams will assist in planning a base. The LA team should be available to the commander during site planning and once the operations begin. Fire prevention should be a high priority on a commander's list. Access to storage areas must allow for movement of fire-fighting apparatus, including water tankers. Temporary water points should be placed for maximum usage in high risk areas. Areas that store HAZMATs should be noted on response charts, and all crews must be made aware of these areas. Material data sheets should be available before an incident occurs for prefire planning.

HAZARDOUS MATERIALS

9-12. Fire-fighting teams must ensure that—

- HAZMATs are stored according to current safety and environmental protection regulations.
- All reactive materials are stored in separate locations in case of a breech of containers.
- All personnel, including the fire-fighting crews, who work in an area where containers are stored are aware of the possible dangers involved with a container breech.

OTHER MISSIONS

9-13. Fire-fighting teams on a logistics base will also assist in rescue operations and in emergency medical services, as required.

INTERNMENT/DISLOCATED-CIVILIAN CAMP

9-14. Fire-fighting teams assigned to protect internment/dislocated-civilian camps are responsible for the following:

- Fire protection and prevention. Fire prevention should be a high priority on the commander's list.
- Assistance in base planning. Fire-fighting teams will be required to assist in base planning. Members of the LA team should be available to the commander during site planning and once operations begin. They should ensure that access to their stations allows for movement of fire-fighting apparatus, including water tankers.

GENERAL-SUPPORT HOSPITAL

9-15. Fire-fighting teams assigned to protect a hospital are responsible for the following:

- Fire protection and prevention. Prevention should be a high priority on the commander's list. Fire-fighting operations must be quick and confining the fire, a priority. Prefire plans and control points should be developed during set up or as soon as possible. The fire-prevention section must monitor the storage of HAZMATs and compressed gasses.
- Support of all MEDEVAC missions. Fire-fighting teams will assist medical personnel in evacuating the sick and injured, when required.
- Assistance in base planning. Members of the LA team should be available during site planning and once the operations begin. They should ensure that access to their stations allows for movement of fire-fighting apparatus, including the water tankers.

Chapter 10

Fire-Fighting Operations Involving Explosives

10-1. This chapter addresses the basic knowledge that firefighters need to handle incidents when munitions, ordnance, or chemical weapons are involved in a fire. The chapter will show the various types of warning signs/placards, how to mark ordnance, and what ordnance should look like. Emergency procedures on when to fight such fires or when to evacuate will be discussed. The last section will cover UXO. In recent operations, lack of knowledge and/or training about UXO has killed more soldiers than the enemy has. Whether at an incident or responding to one, firefighters need to know how to report UXO.

RESPONSIBILITIES

COMMANDERS

10-2. All commanders are responsible for preventing accidents involving personnel operations and activities under their jurisdiction. They are responsible for storing and transporting nuclear, chemical weapons and munitions, and any other HAZMATs. Commanders will ensure that—

- Personnel who handle and transport HAZMATs understand the procedures to initiate when spills, leaks, fires, and other emergencies occur. Chapter 11 details procedures personnel should use in HAZMAT fires.
- Fire departments in the mutual-aid agreement chain are informed of the type of situation that they are responding to and the procedures to use at the scene.
- SOPs address nuclear, chemical, and HAZMAT control and movement, fire-equipment placement, exposure control, and evacuation procedures.

FIRE DEPARTMENTS

10-3. Fire departments provide C^2, fire extinguishment, and HAZMAT stabilization at an emergency site. After controlling an emergency, fire-department personnel monitor the cleanup operations to prevent further life or property loss.

SUPPORT AGENCIES

10-4. Fire departments are not equipped to handle large HAZMAT emergencies. They will need assistance from many of the following:

- Bioenvironmental engineer.
- Base environmental coordinator.
- NBC section personnel.

- Containment and decontamination personnel.
- Medical personnel.

FIRE DIVISIONS

DIVISION 1

10-5. Division 1 deals with Hazard Class 1.1 materials, which are explosives and liquid propellants. The primary hazard is mass detonation. The Department of Transportation (DOT) classifies this division as explosive Class A. When dealing with this hazard, firefighters—

- Perform rescue operations before extinguishing a fire.
- Attempt to extinguish a fire if nonexplosive and explosive materials are separated or if the fire chief approves extinguishing procedures.
- Take protective cover if personal safety is in jeopardy.

DIVISION 2

10-6. Division 2 deals with Hazard Class 1.2 materials, which are fragmentation ammunition and explosives. The primary hazard is explosion with fragments. When dealing with this hazard, firefighters—

- Fight a fire when possible. If not possible, they prevent it from spreading.
- Provide protection from fragments because such items could detonate.

DIVISION 3

10-7. Division 3 deals with Hazard Class 1.3 materials, which are ammunition and explosives. The primary hazard is mass fire. The DOT classifies this division as explosive Class B. When dealing with this hazard, firefighters—

- Fight the fire, if explosives are not directly involved.
- Immerse the white phosphorus (WP) in water or continuously spray it with water if WP ammunition is involved.
- Apply dry sand or dry powder if hexachloroethane (HC) and incendiaries are involved.
- Allow magnesium to cool if pyrotechnics and magnesium incendiaries are involved and if the magnesium is not on flammable materials. If the magnesium is on flammable materials, they spread a 2-inch layer of dry sand or powder on the floor, rake the burning material onto the layer, and mix them together. They protect the adjacent facilities and equipment. Firefighters will not use carbon dioxide (CO_2), Halon extinguisher, or water.

DIVISION 4

10-8. Division 4 deals with Hazard Class 1.4 materials, which are ammunition and explosives. The primary hazard is moderate fires without a blast hazard. When dealing with this hazard, firefighters—

- Fight the fires.
- Should be aware that minor explosions could occur, resulting in the release of hot fragments.

FIRE SYMBOLS

10-9. Figure 10-1 shows the fire symbols that identify the fire divisions. The background color is orange, and the number that identifies the division is black. The symbol color follows the DOT labels and placards for explosive Classes A and B. Symbols indicating special hazards, such as toxic chemicals and nuclear weapons, are displayed in addition to the fire symbols.

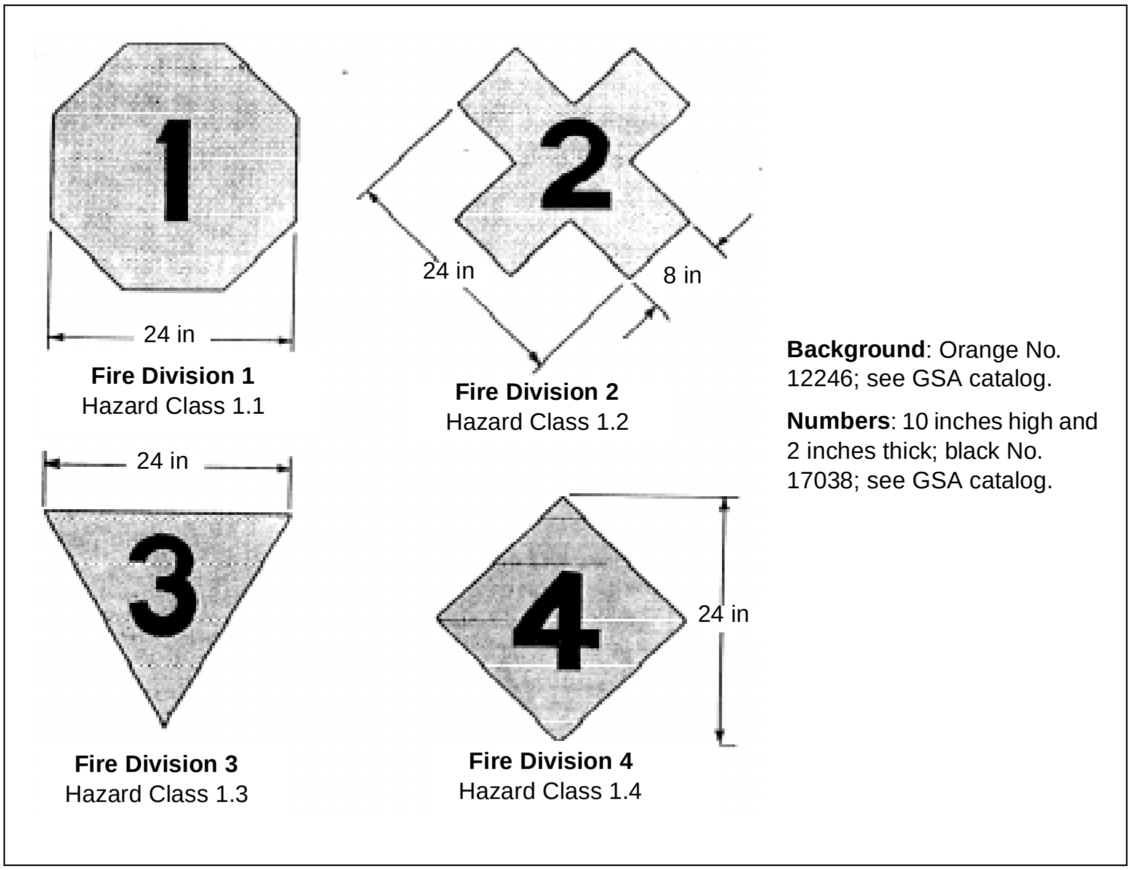


Figure 10-1. Fire symbols

10-10. Fire symbols are displayed on the exterior of buildings and storage sites containing explosives or ammunition. Removable placards or boards showing the symbols may be used on buildings or storage sites in which explosive contents frequently change. The symbols must be visible to

approaching fire-fighting crews from the maximum practicable distance. Fire symbols are not required on earth-covered magazines or on outdoor riveted sites restricted to storing hazard Class 1.1, (18)1.2, (12)1.2, and (08)1.2 materials. However, for safety, commanders may designate blocks in earth-covered magazines as areas containing HAZMATs and may require the display of the appropriate fire symbol.

10-11. Warehouses and other facilities used for storing empty explosive containers that have not been decontaminated will display a division 4 symbol. Buildings containing radioactive materials will use the standard radiation symbol described in 10 Code of Federal Regulations (CFR) 20.1901 and 20.1902.

10-12. While on Army installations, all railroad cars and vehicles containing ammunition, explosives, and HAZMATs must display a fire symbol. Installation railroad cars and vehicles not destined for movement off the installation shall display at least two fire symbols. Installation transport vehicles destined for shipments off the installation, commercial railroad cars, and motor vehicles will display placards according to DOT regulations when containing ammunition or explosives. Fire symbols or placards are placed on all transport vehicles before loading and are removed after unloading. See Figures 10-2 and 10-3 for placard locations on railcars and vehicles.

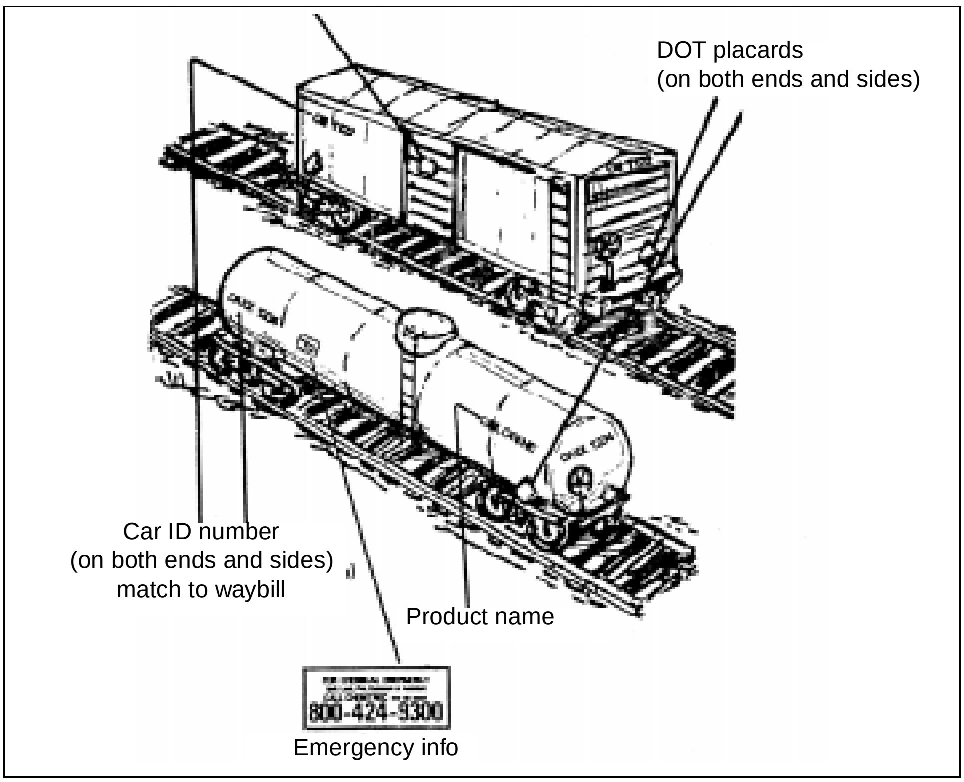


Figure 10-2. Placard placement on railcards

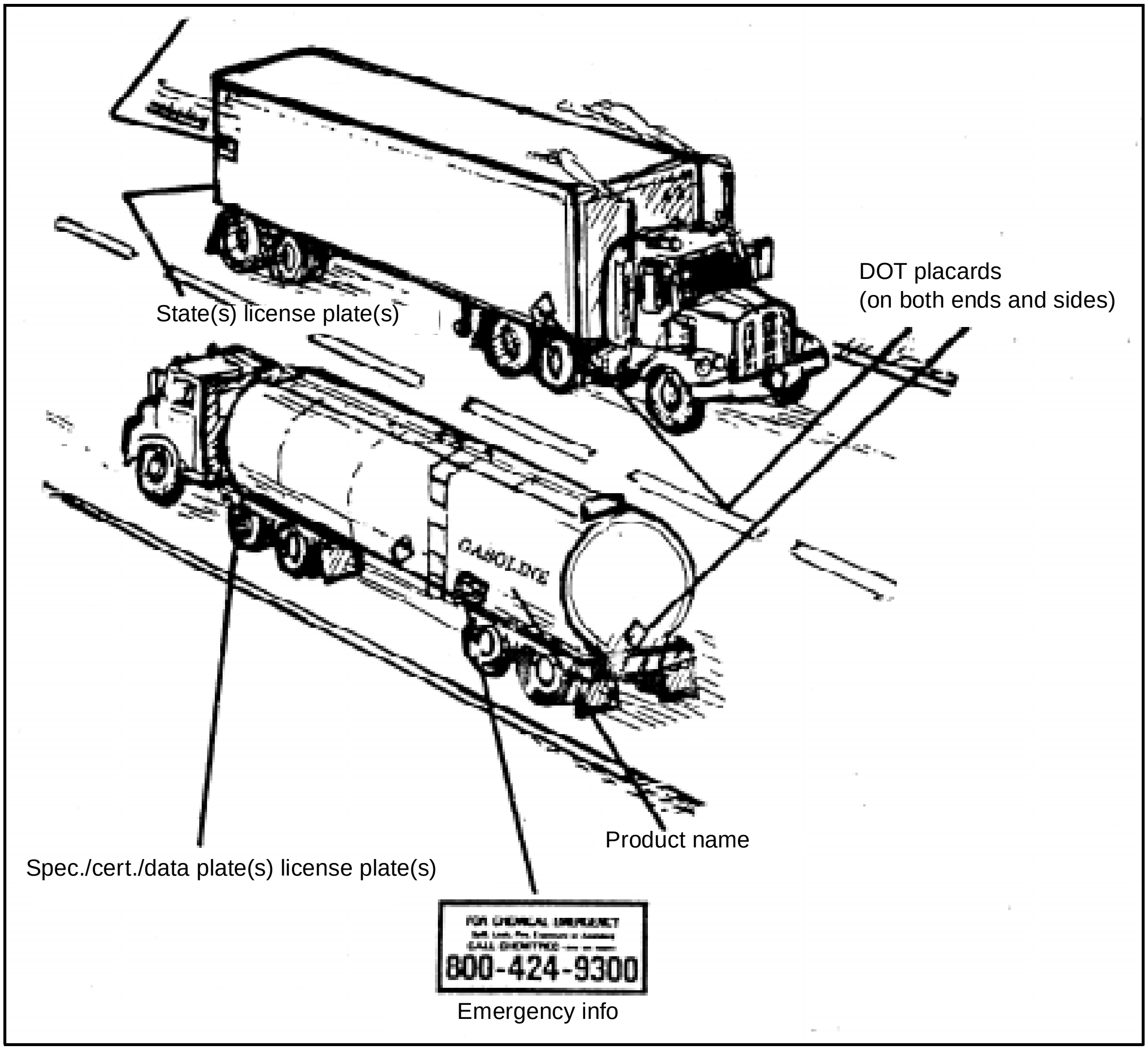


Figure 10-3. Placard placement on trucks

10-13. When the fire symbols or topography- and vegetation-shield symbols are not displayed on structures, maintain a master list or map indicating the storage-site locations, fire and chemical symbols, and empty sites. Update and post this list or map at all the entrances, control stations, and control points servicing the storage location. Fire-fighting, guard, and emergency forces should have a copy of this list or map. This provision for lists and maps does not apply to chemical agents and chemical-munitions storage and operating facilities. The personnel in charge of HAZMAT storage or shipping are responsible for changing the fire symbols or DOT placards when necessary.

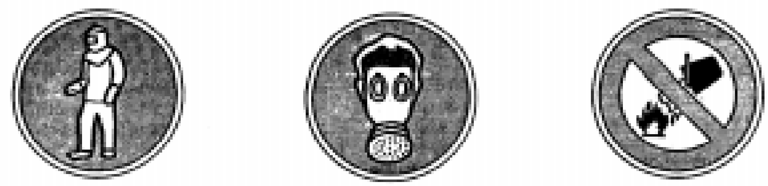
CHEMICALS

10-14. Storage and operating facilities and vehicles that deal with chemical agents and munitions will display the appropriate chemical-agent symbol. Figure 10-4 shows the chemical-hazard symbols. The color of symbol 1 (Figure 10-4) will indicate which set of protective clothing that fire crews must wear. Symbol 2 (Figure 10-4) is posted when there is a presence of incendiary and readily flammable chemical agents. This symbol indicates that fire crews must wear breathing apparatus. Symbol 3 (Figure 10-4) is a warning against extinguishing a fire with water. A dangerous reaction will occur if water is applied. This symbol may be posted with other symbols, if required.

10-15. Below is a description of the chemical-symbol sets. If fire crews are equipped with heat-resistant bunker gear and a protective mask or a SCBA, they do not need the protective clothing identified in sets 2 and 3 when fighting fires involving materials identified in these sets.

- Set 1. The symbols in this set have a blue background and a red rim and figure. The symbol indicates the presence of highly toxic chemical agents that may cause death or serious damage to bodily functions. Fire crews must use the M9 protective mask or SCBA and impermeable suit (hood, boots, undergarments, coveralls, gloves, and protective footwear).
- Set 2. The symbols in this set have a blue background and a yellow rim and figure. The symbol indicates the presence of harassing agents (riot-control agents and smokes). Fire crews must use the M9 protective mask or SCBA, coveralls, and protective gloves.
- Set 3. The symbols in this set have a blue background and a white rim and figure. The symbol indicates the presence of WP and other spontaneously combustible materials. Fire crews must use the M9 protective mask or SCBA and flame-resistant bunker gear.

10-16. Table 10-1, page 10-8, shows the chemical agents most used in ammunition and the combinations of chemical-hazard symbols that are required on chemical-storage facilities.



Symbol 1
Wear full protective clothing

Color:
Background is blue.
Figure and rim are—
Red for set 1 protective clothing.
Yellow for set 2 protective clothing.
White for set 3 protective clothing.

Symbol 2
Wear breathing apparatus

Color:
Background is blue.
Figure and rim are white.

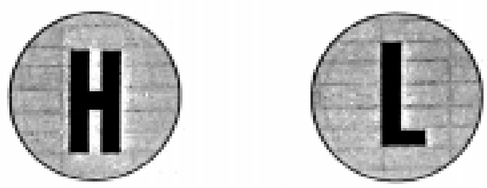
Symbol 3
Apply no water

Color:
Background is white.
Circle and diagonal are red.
Figures are black.

Note: Colors per GSA Catalog: red No. 11105, blue No. 15102, yellow No. 13538, white No. 17875, black No. 17038



1. G-type nerve agents
2. VX nerve agent
3. Incapacitating agent BZ



4. H-type mustard agents
5. Lewisite

Figure 10-4. Chemical-hazard symbols

Table 10-1. Chemical agents used in ammunition

Chemical Agents and Fillers in Ammunition	Full Protective Clothing			Breathing Apparatus	Apply no Water	G	VX	BZ	H	L
	Set 1	Set 2	Set 3							
GB	X					X				
VX	X						X			
H, HD, HT	X								X	
L	X									X
CL, CG, CK, CN, CNS, CS, BBC, DA, DC, DM, FS, FM		X								
HC				X	X					
BZ		X						X		
WP, PWP			X							
TH, PT				X	X					
IM, NP				X						
TEA, TPA			X		X					
Colored smokes				X						

FIRE-FIGHTING PROCEDURES

10-17. How to fight a particular fire will depend on the type of ordnance involved, how long the fire has been burning, how large the fire is, how long the ordnance has been exposed to the fire, and whether or not any personnel are trapped. The SFO must make a quick, accurate decision. However, any decision that he makes must ensure the crew's safety above all considerations.

AMMUNITION AND EXPLOSIVES

10-18. The fire crews must know the specific reactions that occur when ammunition and explosives are exposed to heat or fire. They must be informed of the known hazards and conditions that exist at a fire scene before proceeding to a fire. Ammunition fires containing explosives and chemical agents require special precautions. The crews will follow the procedures for the fire division covering the materials involved in a fire.

Divisions 1 and 2

10-19. Materials in these divisions could detonate, causing a moderate-to-severe fragmentation hazard. The fire crews will not approach the area closer than 1,000 feet for every 50,000 pounds of explosives involved in a fire. Mobile equipment will be kept at a protected location. The fire chief and SFO of the responding unit determine if the facility is safe to approach. They agree on procedures and then direct fire crews on how to approach the facility and

extinguish a fire. The same procedures apply to protecting adjacent buildings from fire.

Division 3

10-20. Fires involving materials in this division produce wide-spread, intense radiant heat that is dangerous to personnel and equipment. If a fire is minor and controllable, fire crews will confine operations to preventing it from spreading to other buildings.

Division 4

10-21. Generally, materials in this division present only a fire hazard. The fire crews fight a fire with portable and mobile fire-extinguishing equipment until it is extinguished.

CHEMICAL WEAPONS

10-22. Chemical weapons are designed to cause injury, disability, or death from skin contact, inhalation, or ingestion of chemical agents. Responding crews must approach the emergency scene cautiously. The success of a chemical-rescue operation will depend on the—

- Knowledge that the fire crews have about chemical-weapons procedures.
- Training that personnel receive using rescue equipment.
- Implementation of suggested changes or improvements that result from discussions about chemical incidents.

10-23. Chemical weapons contain flammables or explosives that propel and disseminate the chemical agent. When exposed to high heat, the agent is consumed and dissipated; however, responding crews cannot accurately determine if a fire has consumed the chemical. Therefore, they must assume that these chemicals are present and must use extreme caution when in or near the smoke from such chemical fires. Military installations that routinely handle chemical weapons will have teams or fire-rescue personnel trained and equipped to perform rescue and decontamination operations. Most fire departments will have HAZMAT teams to assist when necessary.

10-24. The chemicals in weapons are stored as a solid, liquid, or gas but are disseminated as a gas. Therefore, fire crews may not see spills or agents on the ground. They must recognize the symptoms of chemical contamination. The five basic categories of chemical agents and the exhibited symptoms of exposure follow:

Nerve Agents

10-25. Nerve agents are designed to cause death or disability by disrupting the voluntary nervous system (arms, legs, and throat) and the involuntary nervous system (eyes, lungs, and heart). The agents are inhaled or absorbed through the skin. Symptoms include pinpointing of the pupils, tightness of the chest, runny nose, vomiting, and diarrhea, followed by total paralysis and death.

Blister Agents

10-26. Blister agents cause severe blistering, disability, and injury to mucous membranes (mouth, throat, lungs, and eyes). The liquid or fumes of blister agents are inhaled or absorbed by the skin. Symptoms include formation of blisters in the lining of the mouth, throat, and lungs.

Blood Agents

10-27. Blood agents inhibit the blood from using and transporting oxygen to muscle and tissue. Blood agents are absorbed through the skin. Symptoms include disruption of the victim's metabolism and eventual suffocation.

Choking Agents

10-28. Choking agents, which are inhaled, cause inflammation of tissues and of the air passageways. Symptoms include restricting and narrowing of the air passageway, causing the victim to choke.

Riot-Control Agents

10-29. Riot-control agents cause eye irritation and skin burns. The agents are absorbed through the skin. Symptoms include burning sensations and excessive tearing. When notified of a chemical accident, the responding crews will don SCBA and rubber suits, if available. If this equipment is not available, the crews will don full turnout clothing. When turnout clothing is used, access to contaminated areas is restricted.

10-30. The responding crews will advance to the emergency site using the most direct route, keeping in mind wind direction, temperature, and other weather conditions. The fire crews should approach a fire from the upwind side to minimize their exposure. If winds are low or variable, the hazardous areas will be broad. If winds are high, the hazardous areas will be narrow, but will extend further downwind.

10-31. At the scene, the technical advisor determines the action of the responding crews. If a rescue or life-threatening situation does not exist, the fire crews' actions will be to evacuate personnel and prevent a fire from spreading to other areas. If rescue is necessary and the fire crews have adequate protection, they enter the site from the upwind side and cover burning materials with AFFF before attempting rescue operations. When rescue is possible, the rescue personnel—

- Locate the victims.
- Wash the victims' faces with plain water.
- Move the victims to a safe, upwind location.
- Examine the victims for injuries and agent symptoms.
- Wash the victims' open wounds with clear water and cover them with an uncontaminated dressing.
- Release the decontaminated victims to the medical personnel.

10-32. After completing rescue operations, all fire-department personnel will remove their contaminated clothing and wash or shower, using a 5-percent bleach-in-water (HTH) solution. They will check each other for agent

symptoms. No personnel or clothing will be allowed from a site until the commander's technical representative certifies that the clothing and personnel have been decontaminated.

NUCLEAR WEAPONS

10-33. DA policy states that fire personnel should continue to fight a nuclear-weapons or nuclear-components fire as long as they can—

- Prevent loss of life or serious injury.
- Prevent contaminants from scattering, especially plutonium.
- Save burning aircraft, vehicles, and structures and any nuclear contents.
- Prevent property or material damage.

10-34. Nuclear weapons are designed to prevent nuclear yield if accidentally detonated. However, nuclear weapons can yield nuclear material if the mass of nuclear material receives even compression by the detonation of surrounding high explosives. The high explosives and nuclear material are the most hazardous components of nuclear weapons. Other components may produce hazards; however, precautions taken against the high explosive and nuclear materials adequately cover other components.

10-35. Burning high explosives have certain characteristics that fire crews should recognize. The high temperature that oxidizes the explosive causes torching (a hot, forceful flame from burning petroleum fuels or other materials). The smoke of burning explosives has a lighter color than the smoke of other burning fuels. As high explosives burn, they melt and drip, flow, spread, and mix with surrounding materials. High explosives can pick up impurities that make them more dangerous than before they melted.

10-36. Nuclear materials disperse as finely divided particles when the high explosives in the weapons impact or detonate. The nuclear materials in the weapons disperse as oxides if they burn. These particles and oxides are alpha emitters that have very short ranges and cannot pierce the skin. When particles or oxides are suspended in the air, they can be swallowed or inhaled or absorbed through cuts in the skin (a more dangerous source of entry into the bloodstream).

10-37. Inhaling oxidized nuclear material is the principal method by which personnel are contaminated. The hazards are reduced once the particles settle to the ground. Fire crews must be careful not to disturb these particles once they have settled. If they must enter a contaminated area, they should—

- Occupy the area as little as possible.
- Use the SCBA or respirators and wear protective clothing.
- Use a wet handkerchief over their nose and mouth if the SCBA or respirators are not available.

10-38. In any nuclear-weapons emergency, the first priority is to evacuate all nonessential personnel. The minimum clearance distance is 3/4 mile. The SFO assesses the situation and decides whether to fight a fire, maintain fire-fighting efforts, or withdraw from the scene. The amount of time available to

fight a fire varies from a few minutes to an indefinite period, depending on the weapon casings and the intensity and proximity of the fire to the nuclear weapons.

10-39. When possible, fire crews should cool the weapons while controlling a main fire. Water is the most effective agent for cooling. If the available water supply is adequate, they may be able to cool the weapons and extinguish a main fire simultaneously. If the water supply is not adequate for both operations, fire crews should use other agents, such as AFFF, to cool the weapons. The disadvantage of AFFF is that it conceals the extinguished but dangerous residue. If the nuclear weapons are in an area adjacent to a fire, fire crews must try to cool the weapons while extinguishing the fire. If the water supply is not adequate to cover both operations and the weapons are in an area where heat absorption is minimal, they should extinguish the fire.

10-40. When an explosion is imminent, fire crews must withdraw to an area at least 2,000 feet from the fire. They must not attempt to fight the fire. After fire crews do extinguish a fire, they should withdraw to a minimum distance of 2,000 feet from the fire area. Trained disposal and decontamination teams will be the only authorized personnel allowed in the fire area to monitor the activity of the nuclear weapons. All fire personnel and equipment that may be contaminated from the smoke of burning nuclear weapons will be isolated in a separate area. Trained teams will monitor the fire personnel and equipment and release them after decontamination is completed.

10-41. The military services and the Energy Research and Development Administration (ERDA) maintain trained teams. These teams are responsible for and equipped to detect radiation, neutralize weapons, and decontaminate areas containing explosives or nuclear materials. When the military or ERDA is notified of a nuclear-weapons accident, they will dispatch any of the following to the accident area:

- Nuclear emergency teams.
- EOD detachments.
- Radiological-contamination (RADCON) teams.
- Alpha teams.
- Radiological emergency medical teams (REMT).

10-42. On the battlefield, one common hazard is the UXO emergencies that fire-fighting units will respond to as the EOD units conduct their UXO reconnaissance. Because of this, fire-fighting units must coordinate with EOD before entering an area that is contaminated with UXO.

UNEXPLODED ORDNANCE

DROPPED MUNITIONS

10-43. Dropped munitions are those munitions that are dropped by high-attack aircraft or by helicopter. They may be designed to explode on impact or as an airburst, or they may lie in place until disturbed. Dropped types of UXO include the following subgroups:

- Bombs—includes general purpose; demolition; rocket-assisted, armor-piercing; fragmentation; chemical; fire; incendiary; and smoke bombs.
- Submunitions—includes mines and grenades.

PROJECTED MUNITIONS

10-44. Projected munitions are fired by artillery, rockets, or mortars. They may be designed to explode on impact or as an airburst, or they may lie in place until disturbed. Subgroups of projected munitions include the following:

- Projectiles—includes artillery, fine-stabilized, and rocket-assisted projectiles.
- Mortars—includes high explosives, illumination rounds, and WP/ smoke rounds.
- Rockets.
- Guided missiles.
- Rifle grenades.

THROWN AND PLACED MUNITIONS

10-45. Thrown munitions are commonly referred to as hand grenades. They are classified as fragmentation, offensive, antitank, smoke, and illumination. Placed munitions are referred to as land mines. The two types are antipersonnel and antitank.

UXO HAZARDS

10-46. UXO is a hazard to a fire-fighting team because it can kill people and destroy objects, or it may delay a team's response to an emergency, thus causing more destruction. Fire-fighting crews must be observant of response routes and of the AO, especially when responding during or immediately after an attack. Vehicle operators must be aware of all the activities occurring around the vehicle at all times. Crews must watch the entry and exit points for any signs of placed charges set to inflict injuries or death to emergency crews. UXO hazards may also be present at aircraft incidents. The munitions may be scattered on the area of the incident from the impact.

UXO SPOT REPORT

10-47. When crews encounter UXO, their first action should be to stay clear of the area and report to the higher command. An UXO spot report will contain

as much of the following information as possible and be forwarded to the supporting EOD team(s) by the most expeditious means available:

- Line 1—date/time group.
- Line 2—reporting activity unit identification code (UIC) location (grid).
- Line 3—contact method (radio frequency, call sign, phone number).
- Line 4—type of munitions (dropped, placed, projected, thrown).
- Line 5—NBC contamination.
- Line 6—resources threatened.
- Line 7—impact on mission.
- Line 8—protective measures taken.
- Line 9—recommend priority (immediate, indirect, minor, no threat).

Chapter 11

HAZMAT Incidents and Fire Procedures

11-1. This chapter sets the doctrinal standards for actions that the initial-response team will take when responding to a HAZMAT release in the TO. The chapter also outlines the minimum requirements and specific operating guidelines that should be considered when dealing with HAZMAT incidents. All Army fire-fighting teams and soldiers who respond to HAZMAT incidents and the incident commanders who are responsible for managing HAZMAT incidents should follow these recommendations.

SECTION I. HAZMAT INCIDENTS

SCOPE

11-2. Engineer fire-fighting teams will initially handle HAZMAT incidents that they encounter during operations in a combat environment or stability operations and support operations. The degree of response and mitigation of the incident will depend on available resources and the danger to personnel and equipment. The mission of the fire-fighting teams is to provide initial control and containment, investigate, decontaminate, safeguard, and secure the scene of the HAZMAT incident.

11-3. The following items are guidelines for initial-response teams dealing with HAZMAT incidents in a TO. Most of the guidelines also apply to installation fire-fighting detachment initial-response teams.

- Initial-response teams do not correct HAZMAT release sites. They will do everything possible to contain a spill. A specialist (probably contracted) will correct a situation.
- Since each initial-response team is different, the area commander will establish an initial-response team or teams to meet the threat of a HAZMAT release.
- Releases that will require an initial response are located in the rear areas.
- Releases in a main battle area will not require an immediate response; however, they must be corrected after a battle is over.
- During contingency operations, a HAZMAT incident may require initial-response actions, depending on the mission and the HN's requirements.

RESPONSIBILITIES

11-4. Whether military or civilian, all leaders must know how and what to do in case of a HAZMAT incident. The following paragraphs will define those responsibilities and who must carry them out. Regardless of size, a HAZMAT incident can have a serious impact on an operation in either a tactical or nontactical environment.

DEPLOYED MILITARY PERSONNEL

11-5. All military and civilian personnel deployed to a TO will immediately report incidents involving hazardous wastes (HWs) or HAZMATs through their chains of command. All commanders will forward the reports of these incidents to the division or corps Assistant Chief of Staff, G3 (Operations and Plans) (G3).

FIRE-FIGHTING TEAMS

11-6. All fire-fighting units responsible for HAZMAT incidents will be prepared to respond to all HAZMAT incidents within their AO. The primary operational goal of the fire-fighting teams/HAZMAT response teams when dealing with HAZMATs will be isolating and containing the materials.

INCIDENT COMMANDER

11-7. The incident commander will assume control of the scene beyond the capabilities of the first-responder's awareness level. The commander must have training at least equal to that of the operational-level responder's and have additional training relating to HAZMAT incident management. No matter what the level of the incident or the personnel operating at an incident, the incident commander must be trained and competent in the following areas:

- The unit’s SOPs and the TO’s response plans.
- The emergency operations plans.
- The hazards and risks of operating at a scene.
- The unit’s and HN’s resources.
- The importance of decontamination.
- Incident-reporting requirements for before-, during-, and after-response operations.

11-8. The incident commander works from the strategic level and develops the overall response objectives; he should not become involved in tactical operations. He is responsible for the safety of the response personnel, the soldiers in an affected vicinity, and the public. He controls an incident and ensures that only minimal harm occurs to the environment and property.

HAZMAT-INCIDENT RESPONSE PROCEDURES

11-9. The fire-fighting teams and the SFO or noncommissioned officers (NCOs) arriving on the scene of a HAZMAT incident must meet many basic

objectives. These objectives parallel those associated with a fire response and include the following:

- Sizing up the situation and establishing command.
- Controlling access to the scene, securing the scene, and isolating the hazard.
- Identifying the hazard and evaluating the risk.
- Rescuing and evacuating personnel and victims.
- Staging the resources.
- Confirming that applicable hazardous-substance-release reporting requirements have been met.
- Reevaluating the situation (ongoing).

SIZING UP AND ESTABLISHING COMMAND

11-10. The first step in a HAZMAT incident is to size up the situation and establish command. Sizing up is an ongoing process and impacts all the phases of planning and decision making that take place during any incident. Sizing up starts when an incident is dispatched and continues through the entire incident as more information is obtained. Upon receiving a report of a potential HAZMAT incident from military, civilian, or HN sources, the LA team shall initiate a HAZMAT response.

NOTE: HAZMAT incidents could affect tactical missions; the local commands should be contacted immediately.

11-11. An initial HAZMAT response may consist of—

- First responders.
- A local unit/area response team, if applicable or available.
- An incident commander.
- Other fire-fighting teams.

11-12. A HAZMAT incident requires a more cautious, methodical, and deliberate sizing up than most fire situations. Prematurely committing equipment and personnel to unknown, potentially hazardous situations or locations must be avoided. Recognizing and identifying HAZMATs must be performed first. (In HAZMAT incidents involving military personnel and equipment, response teams should already know what materials are involved because of the placards that are on the containers or buildings and the documentation that is on file.)

11-13. After sizing up the situation, the incident commander will establish a set of objectives and the amount of resources that are needed to accomplish the objectives. Factors such as preplanning information, reports from responsible parties or witnesses, odors, visual factors (placards, labels, container size and shape), time, location, and weather play a vital role in formulating the objectives. The critical step to objective development is identifying the hazard and assessing the potential harm.

11-14. First responders should always size up a situation conservatively, with an orientation toward public health and safety. They should concern themselves with their safety and that of the personnel in the vicinity. The SFO will notify the adjacent units and response teams.

CONTROLLING ACCESS TO THE SCENE, SECURING THE SCENE, AND ISOLATING THE HAZARD

11-15. The first action that the commanding officer should take during a HAZMAT incident is to close all access areas to the scene. (If necessary, he could establish controlled access areas to secure a given area properly and prevent needless exposure to dangerous substances.) If the quantity of chemicals or materials involved in the incident is significant, then the incident commander will advise the area commander and his chain of command.

11-16. In most cases, establishing a controlled access area should start with an outside perimeter and work toward isolating the HAZMAT incident. The *hot*, *warm*, and *cold* zones should be established after the outer perimeter is secured. As soon as the zones are defined, and possibly marked with different tape colors, personnel should be assigned to control entry to the zones. These zones are defined as follows:

- Hot—the area that immediately surrounds a HAZMAT incident and then extends far enough to prevent adverse effects from HAZMAT releases to personnel outside the zone. The zone is also referred to as the exclusion zone or restricted zone.
- Warm—the area where personnel and equipment are decontaminated and the hot-zone support takes place. It includes control points for the access corridor and thus assists in reducing the spread of contamination. The zone is also referred to as the decontamination, contamination reduction, or limited-access zone.
- Cold—the area that contains the command post (CP) and other support functions that are deemed necessary to control an incident. The zone is also referred to as the clean zone or support zone.

11-17. The incident commander will establish control as soon as possible. Doing so is necessary to control and direct the operations and movements of the on-site personnel to prevent possible contamination. A site map that shows wind direction and topography could be helpful. Boundaries for the various control zones are established using information based on the—

- Contaminant.
- Wind speed and direction.
- Degree of risk (toxicity) from the HAZMATs.
- Size and location of the spill or release.
- Tactical situation.
- Other factors that are gathered at the incident site.

11-18. Personnel should move only through the access control points to prevent contamination across the zones. Assigned team members should monitor the control zones to ensure that they are properly located as an

incident progresses. Depending on the incident, the control zones may have to be expanded or reduced.

IDENTIFYING THE HAZARD AND EVALUATING THE RISK

11-19. Once a scene is initially secured, the access controlled, and the hazard isolated, the types of HAZMATs must be more positively identified. The incident commander will secure additional information Further identification is necessary to assess the risk that the hazards present to the fire personnel, populace, resources, and environment. Knowing more about a HAZMAT allows the first responders or a HAZMAT team to do the following:

- Determine who must be evacuated.
- Define what personal protective equipment must be used.
- Establish the decontamination sites and procedures.
- Relocate the zones and areas as necessary.
- Identify the needed resources.
- Identify any environmentally sensitive areas.
- Determine what experts and contractors may be required.

RESCUING AND EVACUATING PERSONNEL AND VICTIMS

11-20. Another important factor that the incident commander must evaluate is what is needed to rescue and evacuate victims. Firefighters should not attempt rescuing the people at HAZMAT incidents unless their own safety can be assured. Initial rescue actions should be on removing the ambulatory people from immediate danger. The more complicated rescues or extrications should be evaluated first and then a possible rescue attempt made.

11-21. If a victim cannot be saved or is already dead, fire-fighting teams should not attempt a rescue if they will be at risk. They could be exposed to an unknown chemical or a potential explosion, which makes the risk unacceptable. For information on the suggested minimum safe distances for evacuating personnel, see the *North American Emergency Response Guidebook*. When determining the safe distance, fire-fighting teams should use the worst-case criteria, because it is better to evacuate too large an area than too small an area.

11-22. When fire-fighting teams rescue contaminated victims, the incident commander must arrange to isolate, decontaminate, and treat the victims, as well as the rescuers, as possible casualties. Fire-fighting teams, therefore, must be familiar with handling contaminated people, to include having full protective clothing and equipment available. The incident commander may have to establish a holding area for the contaminated victims until they can be decontaminated or the treatment personnel can be protected. This holding area should be located close to the decontamination area and be considered part of the hot zone. Some of the safety considerations that should be

addressed before attempting to rescue victims during a HAZMAT incident emergency are listed below:

- Has the location of the victims been confirmed?
- How much time will the rescue require? Are the victims trapped by a vehicle or other debris?
- Are the victims conscious or responsive?
- How long have the victims been trapped or exposed to the HAZMATs? Can they function on their own?
- Is the leaking material pooling or vaporizing around the victims?
- What are the hazardous properties of the material involved in the incident?
- Is a large fire or explosion likely?
- What is the release rate of the escaping HAZMATs? What is the concentration of the material in the area by the victims?
- Does the PPE that is available to the rescuer offer a reasonable level of protection against the HAZMATs?
- Is the vehicle or the structure resting in a stable position?
- Are the skill and experience levels of the rescuer(s) adequate?
- Are the proper tools available to initiate a rescue?
- Are adequate personnel resources available for support positions, such as fire suppression, safety, and back-up crews?
- Is decontamination possible?

STAGING THE RESOURCES

11-23. Staging is divided into two levels. Level I involves positioning the standard equipment that occurs as part of any routine response. Equipment and personnel are staged as defined by internal SOPs. Level II involves designating an area in a safe location that provides access for the arriving units and for the units that are assigned to work. A Level II area is usually established after the initial size-up is completed. The incident commander ensures that the arriving units are directed into the appropriate staging area.

11-24. In HAZMAT incidents, Level II staging is recommended because it keeps uncommitted units in a safe location. The area must be far removed from a HAZMAT scene to prevent the worst foreseeable outcome from affecting operations. The route to the Level II staging should not expose personnel to any danger. When units are expected to be on standby for a long time, the Level II staging may be placed at the nearest base camp. It can also be in another area that is close to the incident and offers the personnel a place to eat, rest, or plan and review their potential role. The incident commander must keep a sufficient level of resources in the staging area to handle any escalation of an incident.

Reevaluating the Situation

11-25. The incident commander must constantly reevaluate a HAZMAT incident and his resources as he obtains new information about them. He does this to ensure that the response process will lead to a safe and proper control of the hazard, cleanup, decontamination, and termination of the incident. Also, he must continually update the chain of command and local area commanders.

FIRST RESPONDER

11-26. First responders are those likely to witness or discover a HAZMAT release and those who would be expected to begin emergency-response procedures. First responders include truck drivers, train crews, MP, and others whose duties require them to work in facilities where HAZMATs are transported, stored, or used. Responders are not expected to take any action that would require a great deal of training and experience; their actions are basic and limited.

11-27. First responders may be involved in several different roles and responsibilities at HAZMAT incidents beyond the initial-action stage. The fire-fighting/HAZMAT teams are frequently manned only to a level that allows them to deal with the complex and specialized technical issues during an incident. The other tasks that are required to support a fire-fighting/ HAZMAT team must fall to the first responders. They and a HAZMAT team must be able to work together and function as an effective team. This teamwork approach allows the incident commander to manage the incident in a safe and timely manner. First responders are the support system for the HAZMAT team. Tasks typically assigned to first responders include entry control, decontamination, and logistical and medical support. Other tasks that first responders might do include diking and blanketing nonlethal liquid substances or transferring liquids from damaged containers.

Entry Control

11-28. First responders may control the entry point from a cold zone to a warm zone. If they do, they can allow only those people with specific assignments and who are wearing the appropriate protective equipment to enter a warm zone. This task may be assigned to the MP who are supporting the AO.

Decontamination

11-29. Special attention will be given to personnel and equipment during all HAZMAT operations. Efforts will be made to minimize the number of personnel and the amount of equipment in a contaminated area. The specific decontamination procedures necessary to handle a particular product must be determined carefully. Before fire-department personnel enter a contaminated area, the incident commander shall set up a decontamination station. Weather and/or other factors may make decontamination outdoors impossible. If so, the nearest suitable firehouse (or similar facility) shall be used to decontaminate all personnel and apparatus. During the decontamination process, close attention must be given to water runoff. Wherever possible, this water will be collected and properly disposed of.

SUPPORT

11-30. Support may encompass a wide variety of functions to assist a fire-fighting/HAZMAT team, to include—

- Laying out equipment (suits, radios, and tools).
- Logging information.
- Assisting the entry and backup/rescue team in dressing.
- Communicating.
- Moving bulk equipment.
- Providing rapid-reaction teams.

MEDICAL SUPPORT/EMERGENCY MEDICAL SUPPORT (EMS)

11-31. EMS tasks include those usually associated with basic and advanced life-support treatment of patients or personnel exposed to toxic chemicals. Advanced life-support personnel should function under the direction of a military or civilian medical facility that can best meet and manage the victims who were exposed to toxic substances. Medical personnel will remain in the Level II staging area. Only the incident commander can allow them to enter any other area to provide medical services.

INCIDENT COMMAND

11-32. Incident-command procedures should be used at major HAZMAT emergencies. For major emergencies, you will need to use the resources of and coordinate with units outside the local unit for resolution. The incident commander should establish a CP. He must consider the location of a CP carefully to ensure that it is safe from contamination. He will also determine the safe areas and the restricted areas. The restricted areas will have either a hot, warm, or cold zone.

11-33. Personnel and equipment not immediately needed will be maintained in a ready condition within the Level II staging area. The MP may be called on, as needed, to maintain these restricted areas. The incident commander will ensure that the situation is continually monitored to detect any change in spills, run-off, or vapor clouds. Additional evacuation or other measures should be ordered, as needed.

NOTES:
1. When the specific properties and methods of handling a material are absolutely certain, the incident commander will communicate either directly or indirectly with the Chem-Trec Office at (800) 424-9300 CONUS and (703) 483-7616 outside CONUS, 24 hours a day. If you use the outside CONUS number, you can place collect calls and Chem-Trec will accept them.
2. For incidents involving explosives and/or ammunition, call the US Army Operations Center at (703) 697-0218/0219.

SAFETY PROCEDURES AND SITE SAFETY

11-34. When dealing with a HAZMAT release, following safety procedures is critical for a successful mission and the safe removal of the spill in a timely

manner. HAZMAT incidents present unusual threats that may result in immediate injury (burns from a flash gasoline fire) or long-term injury (unexpected future illness from brief exposure to poisons). The severity of harm from exposure to a HAZMAT depends on the composition and basic properties of the material; the dosage, route, and conditions of exposure; the susceptibility of the person exposed; and other factors. All unit personnel must be extremely cautious to ensure minimum exposure.

11-35. Some of the immediate effects of high-level, brief exposures include burns, rashes, nausea, loss of eyesight, and poisoning. Prolonged exposure to low doses of certain materials can cause chronic lung disease, heart disease, or sterility. Firefighters working in a HAZMAT release area must follow specific safety considerations. They must—

- Walk cautiously to avoid tripping.
- Never walk on drums and be very careful when working with stacked drums.
- Always stand to the side when opening doors of vehicles containing HAZMATs.
- Always use a pike pole to open the doors because the items inside the vehicle have probably shifted during the accident.
- Determine the condition of all containers before trying to move them.
- Assume all unlabeled containers contain HAZMATs.
- Stay out of all liquid material when possible.
- Always ground and bond when transferring flammable liquids.
- Stay upwind of the release.
- Spend as little time as possible in the hot zone to avoid prolonged exposure.
- Always have a decontamination area set up.
- Always have a backup team ready.

TECHNICAL INFORMATION

11-36. Early into an incident, the response team should obtain as much information as possible about the immediate and long-term health effects of the material and the way it reacts. All unidentified materials should be considered harmful until proven otherwise.

PROTECTION OF PERSONNEL

11-37. Full protective equipment and clothing should be the minimum protection for all personnel who are in an incident's area. This rule is very important when the HAZMAT class is unknown, the approach to the incident is downwind, or the harmful effects are obvious (for example, victims are down or the surroundings are discolored). Information on health aspects will obviously determine the type of personal protection required to operate safely inside a contaminated area and will ultimately assist the incident commander with determining the response teams' objectives.

OPERATIONS

11-38. Personnel assigned to work in a potentially dangerous HAZMAT area should have an operations plan for that area. The command and the personnel assigned to work in such an area should develop the plan. However, the incident commander and an officer assigned to carry out the operations usually develop the operations plan. Including the incident commander in the developing process helps to—

- Determine the objectives.
- Determine if the proper tools are available for plugging or controlling a spill.
- Reduce exposure time of the personnel at the incident.
- Establish the areas of responsibility.

11-39. The plan should include other factors such as the following:

- Personnel assigned to work within an incident's area should never enter the warm or hot zone until the health risks and how the material reacts have been checked.
- Units are not to enter a vapor cloud or otherwise contaminated area until the area is deemed safe or until personnel wear proper protective clothing.

11-40. Because the conditions in a HAZMAT area can deteriorate at any time, changes may be necessary. Determining and enforcing any changes should be based on an evaluation of the conditions, a judgment of alternatives, and the experience and training of the persons suggesting the changes. Above all, safety in determining and enforcing changes must be the top consideration.

EMERGENCY MEDICAL TREATMENT

11-41. A MEDEVAC vehicle/ambulance should be positioned upwind of a HAZMAT release at the perimeter of the incident's area. Doing so prevents the ambulance and personnel from being contaminated or from spreading a contaminant. Medical personnel should be briefed on the materials involved in an incident so that they can prepare for potential problems. If possible, one fire-fighting team should be assigned to a medical-treatment area to assist with decontamination. The team could help in removing contaminated clothing, operating emergency showers, and administering general treatment. If poisons are involved, the manufacturer and/or a poison-control center for treatment information should be contacted, in case there is injury or contamination.

11-42. When airborne contaminants are involved, additional eyewash kits and oxygen may be needed. Specifically requesting these supplies, rather than additional medical units, may be necessary. There are several problems related to emergency medical personnel safety that should be considered:

- Medical personnel usually do not have positive-pressure SCBA and should not be committed to a dangerous area without protection.

- Victims of HAZMAT incidents may be contaminated and could contaminate emergency medical personnel, hospital personnel, and others.
- Medical personnel should consider the reactivity of HAZMATs when handling victims (for example, oxygen could cause a deflagration).
- Contact lenses of victims should be removed and their eyes flushed well.

PERSONAL PROTECTION EQUIPMENT

11-43. Protecting personnel during a HAZMAT incident must begin before one occurs. A clearly written policy about wearing PPE and clothing must be established and enforced at the unit level. You must learn and know about the necessity of PPE before responding to an incident. Full protection includes the helmet, positive-pressure SCBA, coat, pants, rubber boots, and gloves. Full PPE and clothing prevent vapors, liquids, and solids from contacting the skin.

11-44. At many incidents, your conventional gear is insufficient. For example, corrosives can eat away turnout coats in 1 to 2 minutes. In such an incident, you will need clothing that is especially designed to protect against a specific hazard. You will need vinyl or rubber acid suits, for example, when operating in corrosives, concentrated anhydrous ammonia, and some types of poisons. Several safety problems, and their solutions, associated with PPE and clothing include the following:

COMMUNICATING INSIDE ACID SUITS

11-45. You must adopt and practice hand signals to use when you are in trouble. The most important are—

- “Cool me down.”
- “I'm low on air.”
- “My suit has been breached.”
- “Let's back out.”

REMOVING FACE PIECES BEFORE LEAVING AN AREA

11-46. Always walk clear of an incident area to where others are breathing without protective equipment. Decontaminate your clothing by letting someone else flush it with water. Never take your gloves off to remove the breathing apparatus face piece until your clothes have been decontaminated.

11-47. If a HAZMAT incident involves poisons or radioactive materials, a separate decontamination site should be established. This area should be used only for cleaning or disposing of equipment. If your clothing has been contaminated with any of these materials, use that site. Also, the runoff water from cleaning should be retained by diking or diverting or by using ponds.

WORKING WITH AN AIR SUPPLY

11-48. Always keep your air cylinders full, and check their gauges before entering an incident area. Never use compressors within 2,000 feet of any HAZMAT incident. Contaminants may enter the filtering system and the

resupplied air cylinder. Never fill cylinders downwind of a spill, leak, or burning fire. The purpose of PPE and clothing is to shield or isolate individuals from the chemical, physical, and biological hazards that they may encounter during HAZMAT responses.

TOOLS AND EQUIPMENT

11-49. Small hand tools are readily accessible, easy to use, and relatively inexpensive. When used with readily available supplies, hand tools can effectively control nearly 80 percent of all HAZMAT container leaks. For example, a 1-inch hole in a leaking gasoline drum can be controlled to a slow drip by driving a wooden plug into the hole. One way to determine the tools you may need is to survey the HAZMAT sites in your response area and compile a kit, or kits, accordingly. Table 11-1 shows a list of items to include in response kits.

Table 11-1. Suggested tools for response kits

Tools	Equipment	Expendable Supplies
Flashlights	Portable hand pumps	Wood and plastic plugs
Pocketknife for carving wooden plugs	Explosimeter	Aluminum and lead tape
Medium-weight ball-peen hammer		Epoxy
Rubber mallet		Gasket materials
Sledge hammer		Drum clamps
8-inch vice grips		Recovery drums/ overpacks
10-inch crescent wrench		
Wire brush with long handle		
Slip-joint pliers		
Bolt cutter capable of cutting heavy chain		
Hacksaw with quick disconnect for blades		
Screwdriver set with various blades		
Ratchet screwdriver		
Pliers, regular and needle nose		
Tin snips		
Sheet-metal shears		
Point, flat, half-round, and rat-tail files		
Chisel set for cutting metal		
Drive socket sets, 3/8 and 1/2 inch		
Box-and open-end wrench set		

SECTION II. HAZMAT FIRE PROCEDURES

NUCLEAR FIRES

11-50. The first person to see a fire involving nuclear materials should use the following procedures:

- Report the fire to the nearest military or municipal fire department.
- Ask the first arriving official (police or fire department) to notify the nearest military installation or EDRA office.
- Give immediate assistance to personnel, when possible.
- Keep away from the fire except to save lives. Highly explosive components may detonate.
- Remain upwind and uphill from the fire.
- Use any available method to prevent smoke from entering your eyes, nose, and throat.

STORAGE FIRES

11-51. Weapon-storage facilities will vary with geographical areas. Normally, a weapon-storage area will be in—

- An underground magazine.
- An earth-covered igloo magazine.
- Outdoor storage.
- Rudimentary storage.

11-52. Personnel at weapon-storage locations are restricted in using flammable materials and flame-producing devices. Because of these restrictions and the high order of supervision and care required, fires seldom occur in these facilities. However, other fire potentials, such as a building's electrical system, the storage hydraulic systems, and the systems on forklifts, may be present and should be considered, eliminated, or controlled. When a fire occurs in a weapon-storage location, the first person to see the fire should use the following procedures:

- Send another person to notify the fire department as soon as possible.
- Apply extinguishing agents immediately to extinguish the fire or control its spread.
- Cut off the electrical power.
- Remove items such as forklifts to a safe area, if necessary.
- Remove all the weapons from the storage location and relocate them a safe distance from the fire, if possible.

RAIL FIRES

11-53. The first person to see a rail fire should—

- Send another person, if possible, to the fire department to get help.
- Apply agents, immediately, from portable extinguishers.
- Isolate the burning car.
- Inspect the burning car's interior to see if the fire has penetrated.
- Fight the fire with any available fire-fighting equipment if the fire has reached the interior but the weapon is still safe from fire.
- Remove all the weapons, if possible.
- Evacuate all personnel when an explosion is imminent.

TRANSPORT-VEHICLE FIRES

11-54. Some of the most common causes of vehicle fires are electrical short circuits, collisions, improper fueling techniques, overheated brakes and tires, broken fuel lines, and careless smoking habits. Because vehicle fires can occur anywhere and anytime, the courier and driver must know and understand the procedures to combat a fire. Personnel who operate transport vehicles should use the following procedures to combat fire emergencies:

- Try to prevent the weapon's highly explosive component from detonating. If possible, separate the burning tractor from the van containing the weapon, apply agents from portable fire-extinguishing equipment, and unload the weapon from the vehicle.
- Evacuate all personnel from the area if the situation involves spillage of flammable liquids or petroleum fuels or the detonation of a weapon's highly explosive component. Roadblocks should be established with a minimum distance of 3/4 mile.

TACTICAL-VEHICLE FIRES

11-55. A fire involving tactical vehicles will vary in origin. Depending on the seriousness and the location of a fire in relation to the weapon, the driver and courier will either combat the fire immediately or evacuate the area before fighting the fire. The local military commander (not the fire-department incident commander) determines the action to take under emergency conditions.

11-56. You need to ascertain whether a fire involves just the ordnance (rockets and missiles) or the ready-to-launch rockets or missiles on a launcher. If a fire involves the carrying vehicle or launcher, try to unload the vehicle and isolate the complete weapon from the fire. If you cannot unload the vehicle, position the vehicle or launcher so that the rocket will impact on a solid earth mass, which will help if the motor ignites.

WEAPON-OPERATION FIRES

11-57. Electrical fires are most likely to occur during electrical testing or monitoring of a weapon. A fire may occur in a warhead section, in the cables

leading to the weapon, or in the test equipment. Only qualified personnel should deal with electrical fires. Personnel at the storage site should use the following fire-fighting procedures when weapons are not in shipping containers:

- Use a fire extinguisher to fight a fire while it is in the incipient state.
- Cut off the power from the weapon or tester. If smoke or flames emanate from the wiring, use Halon to extinguish the flames. Smoke from some electrical apparatus may be toxic. Take the necessary measures to prevent breathing the fumes.

MISSILE FIRES (WITH OR WITHOUT WARHEADS)

11-58. When flammable and explosive components for guided missiles and heavy rockets are properly stored, fire-prevention precautions and fire-extinguishing procedures are simple. The missiles' training manuals or standard texts list the appropriate extinguishing agent for each combustible component.

11-59. When a missile is being placed in the *ready* condition, the flammable and explosive components are close together. The method and duration of a fire-extinguishing action changes. Extinguishing actions are further complicated because one agent may not be correct for other components involved.

11-60. Because missiles are different in type, size, and design, fire personnel cannot establish general-fire plans and standards to cover all missiles. Commanders of missile units must have detailed fire plans, and every member of the unit must know what to do in any circumstance. When a fire does occur, all personnel not involved in extinguishing the fire or relocating other missiles will evacuate the area.

INERT MISSILE

11-61. An inert missile is an unfueled missile without a warhead, boosters, solid propellant motors, or other dangerous components. Use the following procedures when an inert missile is involved in a fire:

- Use any available extinguishing agent and appliance.
- Do not direct straight water streams against burning magnesium. A violent reaction and splattering of the molten metal will occur.
- Use a chemical extinguisher or water to extinguish the fires that are adjacent to the burning magnesium. Doing so helps reduce the temperature of the magnesium below its ignition point.

PARTIALLY COMPLETED MISSILE

11-62. When a partially or completely fueled, liquid-propellant missile, without a warhead or boosters, is involved in a fire, direct large volumes of water at its base. Use foam if the burning fuel is a flammable liquid. If a fire is

on the ground, try to flush the burning fuel away from the missile or try to relocate the missile. All personnel will evacuate the area when and if—

- The surface of the missile starts to melt.
- You can see the brilliant white glow of burning magnesium.
- Destroying the missile cannot be prevented.
- Smoke and flames prevent you from determining the condition of the missile.

COMPLETE MISSILE

11-63. When a missile is fueled and it contains a warhead, take action only if you can extinguish the fire or control it so that the missile will not be enveloped in flames. If a fire is on the ground, apply large volumes of water or foam to flush any burning liquid away from the missile. If the water supply is sufficient, direct a water stream on the surface of the missile to cool it.

Appendix A

Metric Conversion Chart

To Convert	Into	Multiply By
Acres	Square meters	4,047.0
Cubic feet	Cubic centimeters	28,320.0
	Cubic meters	0.02832
	Liters	28.32
Cubic inches	Cubic centimeters	28,320.0
	Cubic meters	1.639 x 10-5
	Liters	0.01639
Feet	Centimeters	6.0
	Kilometers	3.048 x 104
	Meters	0.3048
	Millimeters	304.8
Gallons	Cubic centimeters	3,785.0
	Cubic feet	0.1337
	Cubic inches	231.0
	Cubic meters	3.785 x 10-3
	Liters	3.785
Inches	Centimeters	2.540
	Meters	2.540 x 10-2
	Millimeters	25.40
Miles (statue)	Centimeters	1.609 x 105
	Kilometers	1.609
	Meters	1,609.0
Miles per hour	Centimeters per second	44.70
	Kilometers per hour	1.609
	Kilometers per minute	0.02682
Pounds	Kilograms	0.4536
Pounds per square inch	Kilograms per square meter	703.1
Square feet	Square centimeters	929.0
	Square meters	0.09290
	Square millimeters	9.290 x 104
Square miles	Square kilometers	2.590
	Square meters	2.590 x 106
Tons (short)	Kilograms	907.1848
	Tons (metric)	0.9078
Yards	Centimeters	91.44
	Kilometers	9.144 x 10-4
	Meters	0.9144
	Millimeters	914.4
NOTE: For temperatures: Celsius = 5/9 (F° - 32°), and Fahrenheit = 9/5 (C° + 32°).		

Appendix B

Aircraft Prefire Plans

B-1. Firefighters could encounter many different types of aircraft in a TO. The aircraft will be either rotary wing or fixed wing. The armament and hazards of these aircraft can be varied, extensive, and quite lethal. Firefighters must acquire and maintain knowledge of the aircraft particular to their AO. A copy of TO 00-105E-9 should be available to the CFR crews. This manual contains most of the fixed-wing and rotary-wing aircraft, crash/rescue data, and aircraft specifications for all the services. Because the TO is not always available, this appendix will contain most of the aircraft that Army firefighters in a TO may encounter.

FAMILIARIZATION

B-2. The different types of aircraft make fire fighting and rescue complex. For successful operations, you should be familiar with the following aspects of Army aircraft:

- The characteristics of the various types of aircraft, for visual identification.
- The locations of the entrance points.
- The locations and capacities of the fuel tanks.
- The locations and capacities of the oil tank, hydraulic reservoir, and anti-icing reservoir.
- The locations of the batteries.
- The locations of the oxygen cylinders.
- The features of the ejection seats: how to operate the seats and how to prevent accidental ejection.

SPECIFICATIONS

B-3. Pages B-3 through B-101 are extracts from TO 00-105E-9. The extracts are of aircraft that have been identified as primary Army aircraft and/or Air Force aircraft that support Army missions.

B-4. The rotary-wing aircraft, helicopters, addressed in this appendix are the—

- AH-1 Huey Cobra, pages B-3 through B-7.
- AH-64 Longbow Apache, pages B-8 through B-13.
- CH-47 Chinook, pages B-14 through B-17.

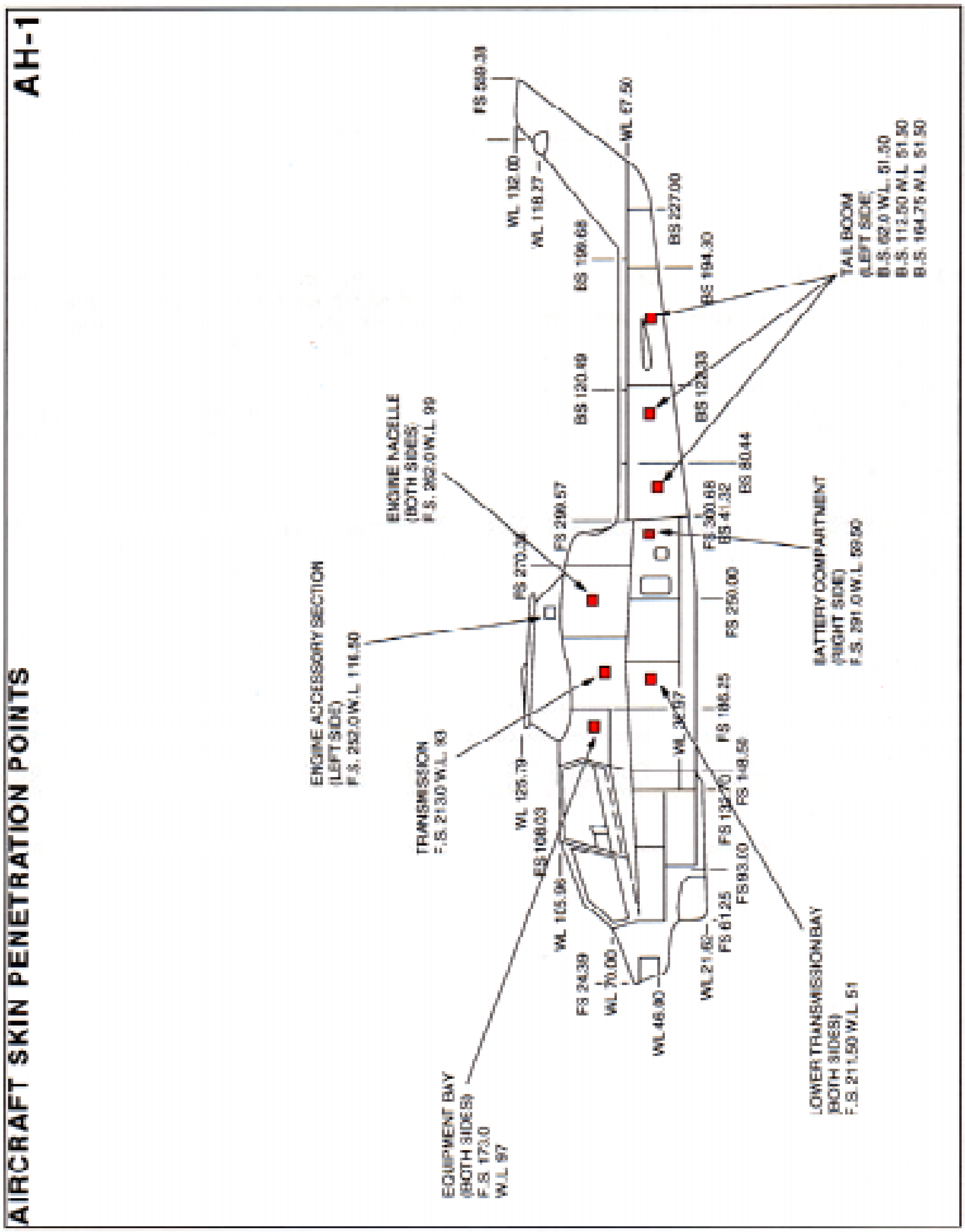
- CH-54 Tahre-Skycrane (National Guard and Reserves), pages B-18 through B-20..
- OH-6 Cayuse, pages B-21 through B-23.
- OH-58 Kiowa, pages B-24 through B-26.
- UH-1 Iroquois, pages B-27 through B-30.
- UH-60 Blackhawk, pages B-31 through B-33.

B-5. The fixed-wing aircraft addressed in this appendix are the—

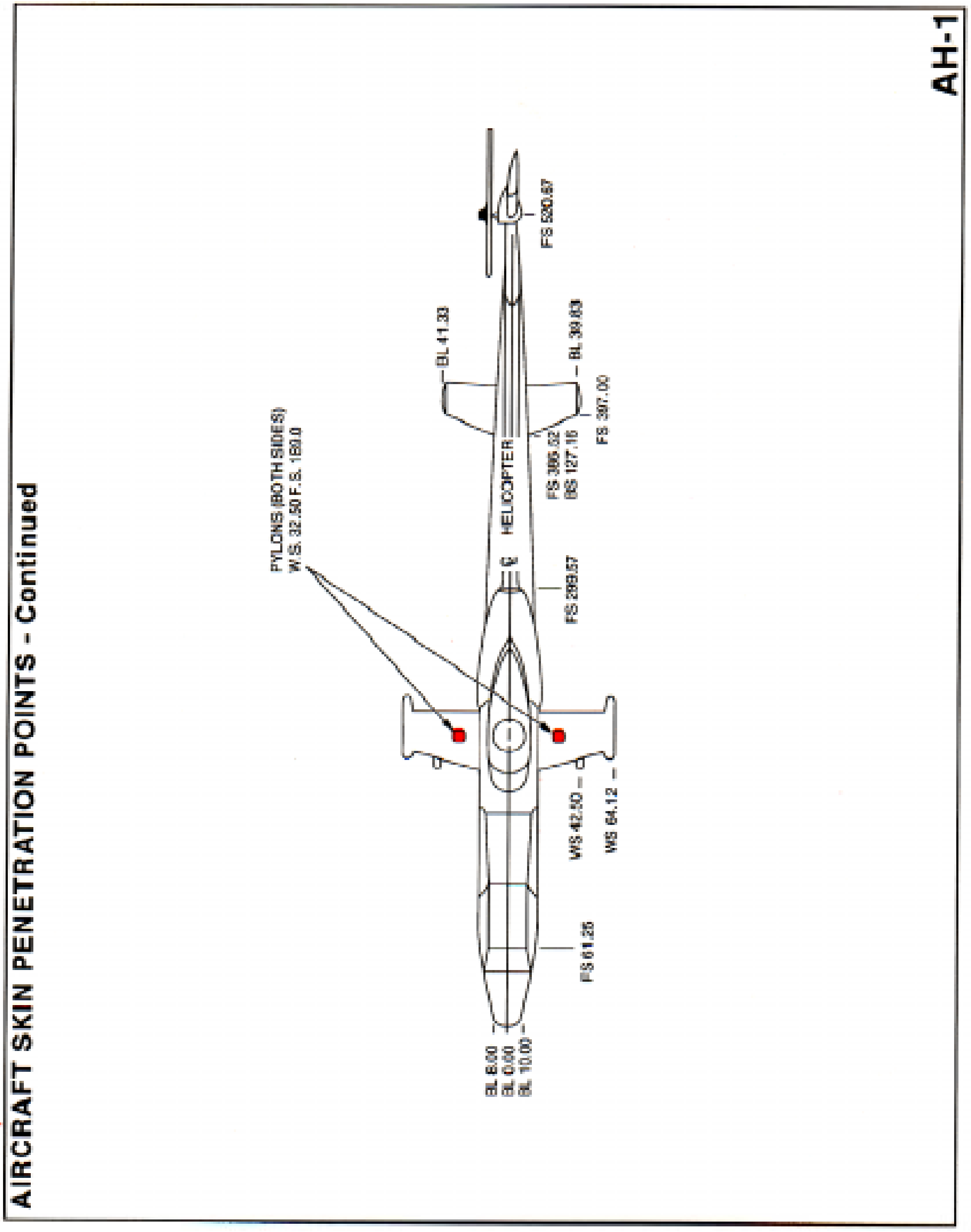
- C-5 Galaxy, pages B-34 through B-46.
- C-12 Huron, pages B-47 through B-53.
- C-17 Globemaster III, pages B-54 through B-80.
- C-130 Hercules, pages B-81 through B-89.
- C-141 Starlifter, pages B-90 through B-95.
- OV-1 Mohawk, pages B-96 through B-99.
- U-21 King Air, pages B-100 and B-101.

AH-1 Huey Cobra

TO 00-105E-9



13-2


AIRCRAFT SKIN PENETRATION POINTS - Continued
AH-1
PYLONS (BOTH SIDES)
W.S. 32.50 F.S. 150.0
HELICOPTER
BL 41.33
FS 397.00
FS 299.57
WS 42.50
WS 64.12
FS 61.25
BL 8.00
BL 0.00
BL 10.00

SPECIAL TOOLS/EQUIPMENT
Power Rescue Saw
Disarming Tool
Crash Axe

AH-1G

AIRCRAFT ENTRY ALL MODELS

WARNING

Any rotation of gun barrels will cause guns to fire.

1. NORMAL ENTRY

a. Rotate pilot's canopy handle, located on right hand side of aircraft beneath aft canopy, up and raise canopy.

b. Rotate gunner's canopy handle, located on left side of aircraft beneath forward canopy, up and raise canopy.

2. EMERGENCY ENTRY

NOTE:
If canopies are inoperable break canopy as necessary to reach jettison handle.

a. Rotate pilot's canopy handle, located on right hand side of aircraft beneath aft canopy, down and raise canopy.

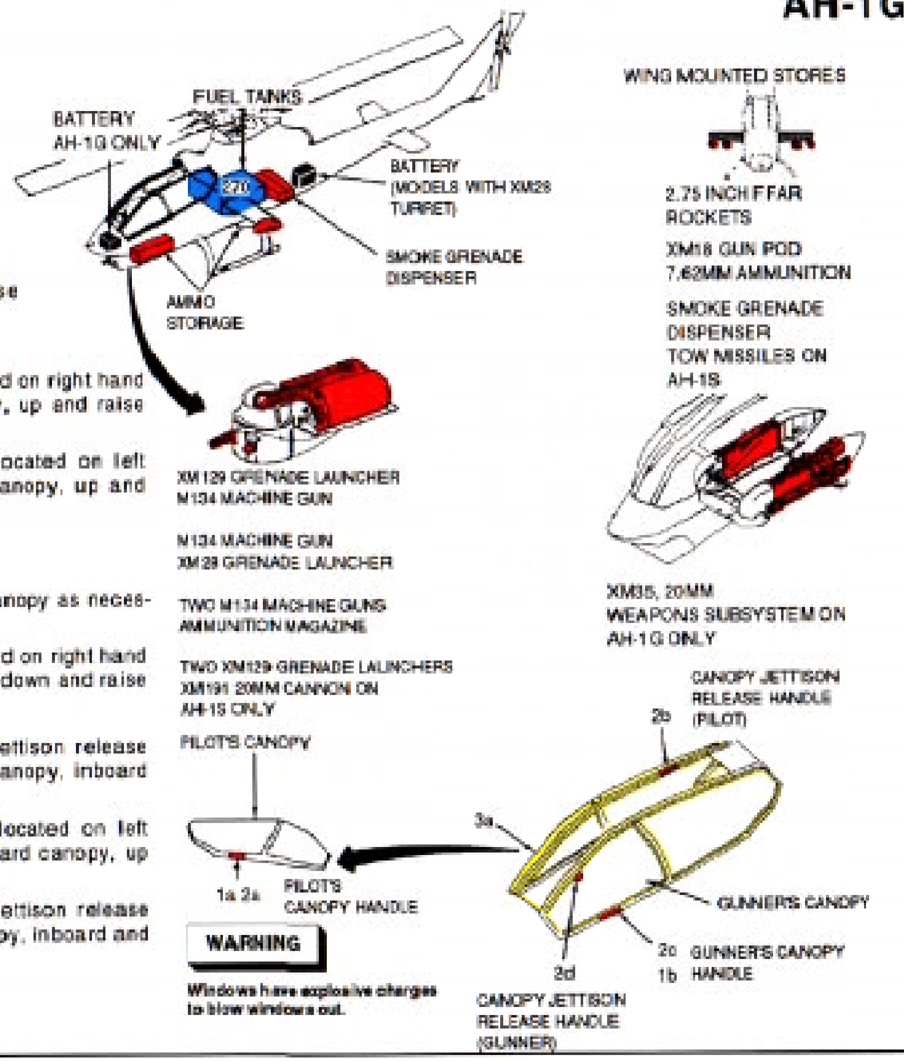
b. Reach inside and rotate canopy jettison release handle, located at top center of canopy, inboard and pull canopy out.

c. Rotate gunner's canopy handle, located on left hand side of aircraft beneath forward canopy, up and raise canopy.

d. Reach inside and rotate canopy jettison release handle, located top center of canopy, inboard and pull canopy out.

3. CUT-IN

a. Cut-in canopies as required.



WARNING

Windows have explosive charges to blow windows out.

ENGINE SHUTDOWN AND AIRCREW EXTRACTION

1. ENGINE SHUTDOWN

a. Depress idle release stop button, located on pilot's collective pitch stick at pilot's left side and rotate throttle to FULL OFF position.

NOTE:
The fuel switch is spring-loaded and must be pulled up before switch can be moved.

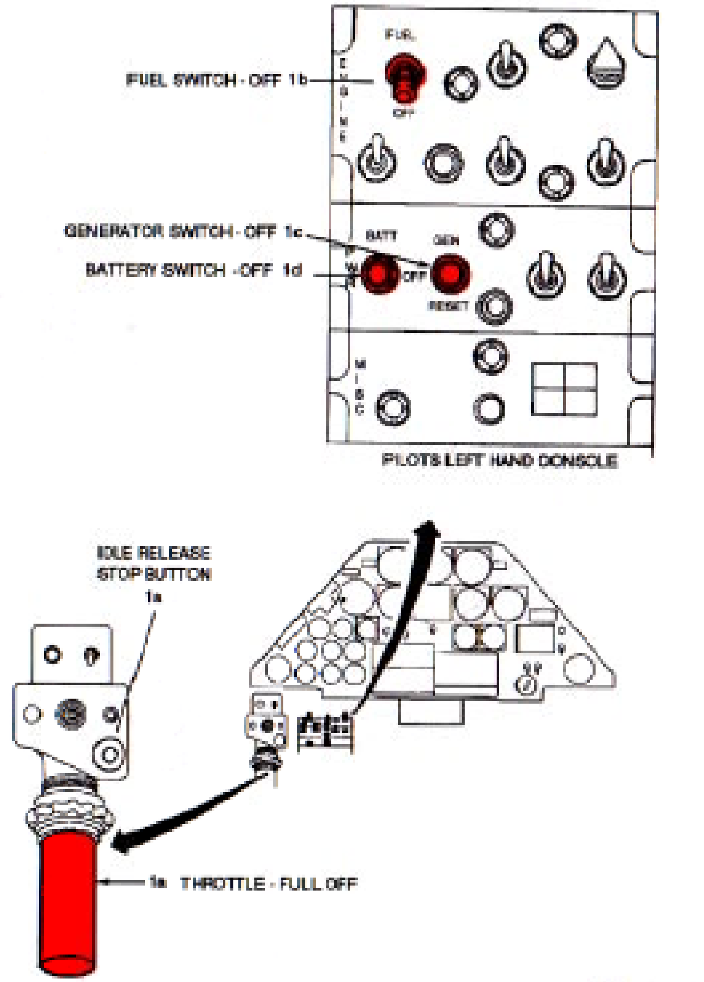
b. Place fuel switch, located on engine control panel at pilot's left side, in OFF position.

c. Place generator switch, located on power panel at pilot's left side, in OFF position.

d. Place battery switch, located beside generator switch, in OFF position.

2. AIRCREW EXTRACTION

a. Unlatch lap belts and remove shoulder harness from crewmember(s).



ENGINE SHUTDOWN AND AIRCREW EXTRACTION – Continued

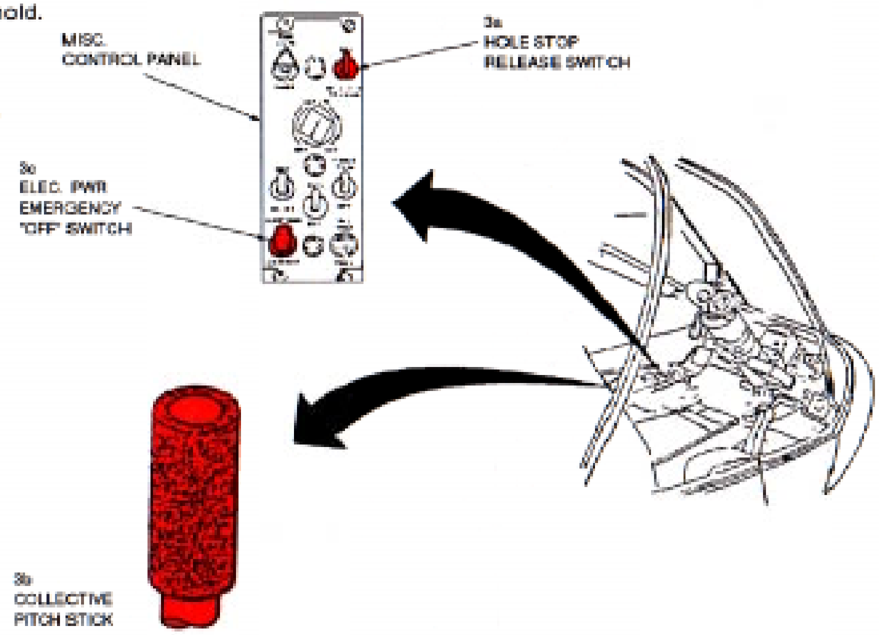
AH-1G

3. EMERGENCY ENGINE SHUTDOWN (FRONT COCKPIT)

a. Place hole stop release toggle switch, located on the misc. control panel at the gunner's left side, to ON position and hold.

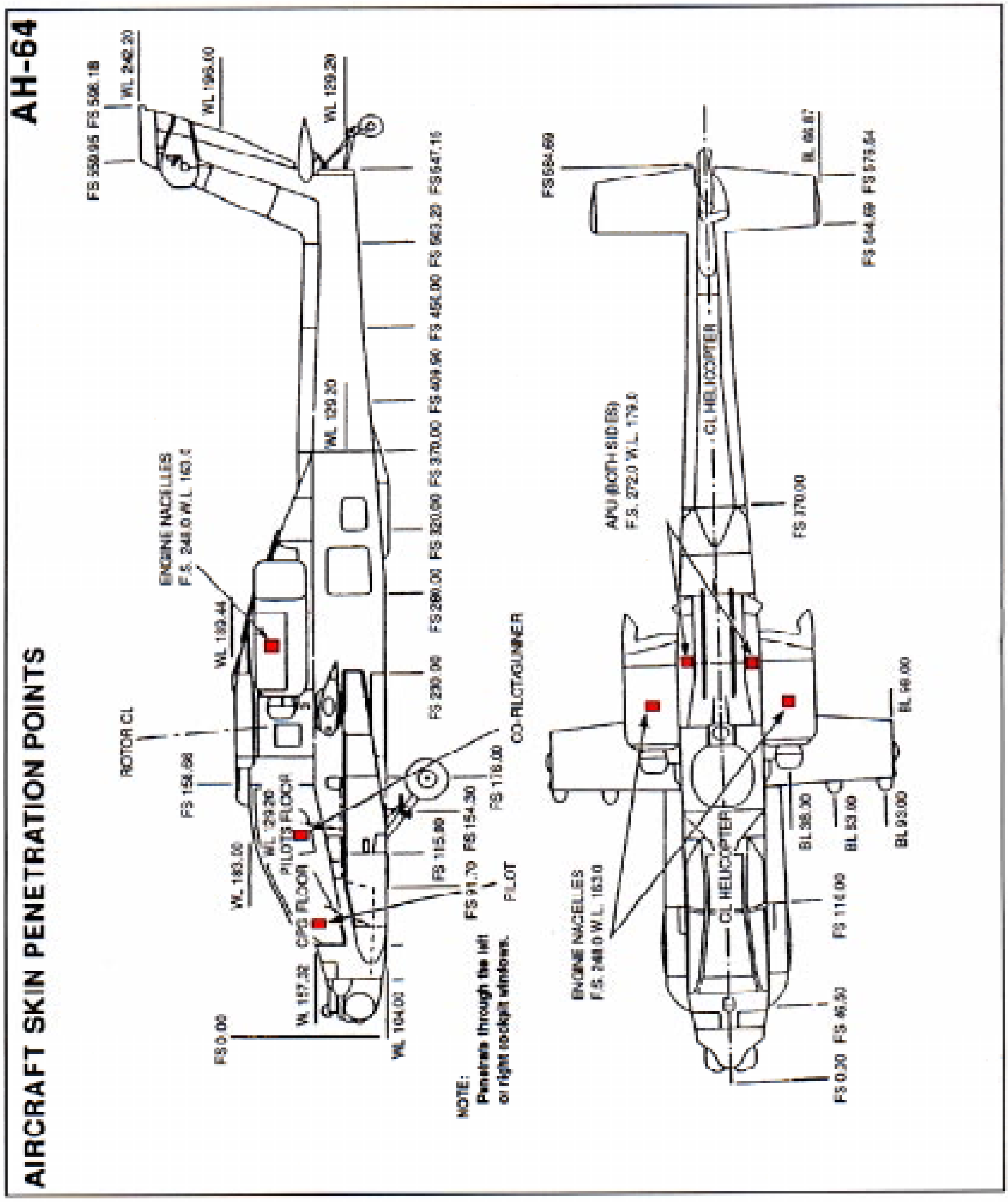
b. While holding the hole stop release switch ON, turn the collective pitch stick, located at the gunner's left side, counterclockwise and hold.

c. While holding the collective pitch stick counterclockwise, release hole stop release switch and place the ELEC PWR EMER OFF switch, located on the misc. control panel, to OFF.



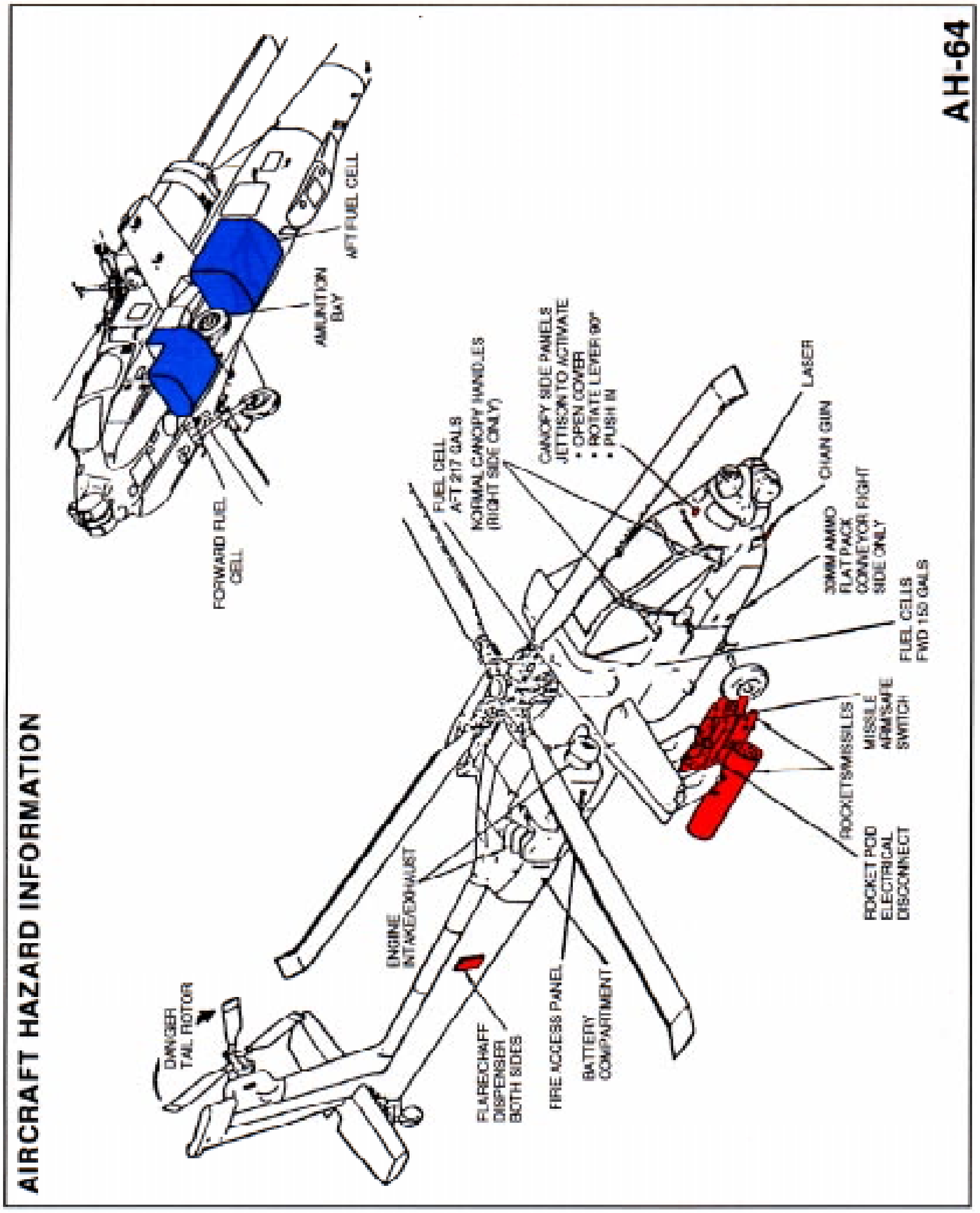
A-H 64 Longbow Apache

TO 00-105E-9



13-8

TO 00-105E-9



13-9

AIRCRAFT ENTRY

AH-64

1. NORMAL ENTRY

NOTE:
Entry can only be accomplished from the right side of the aircraft.

a. Rotate canopy unlock handle, located on the forward lower corner of each cockpit, up to unlocked position and raise canopy door to maximum height.

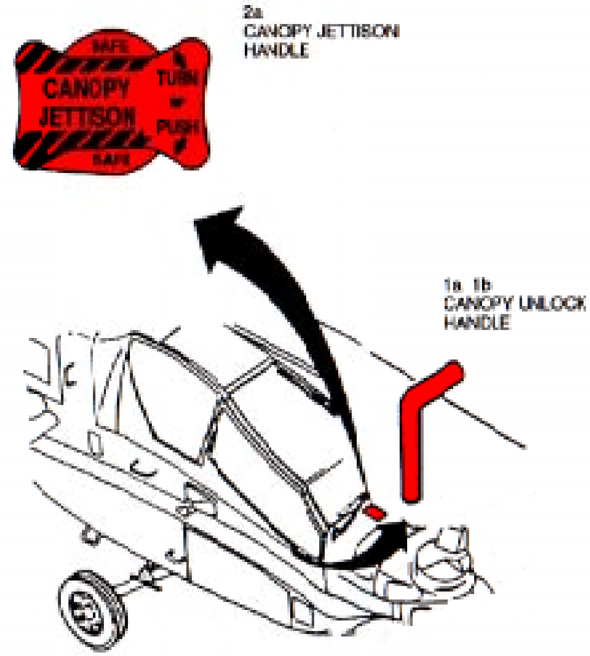
b. Rotate handle back to the horizontal position to lock canopy door open.

2. EMERGENCY ENTRY

WARNING

Activating the canopy jettison system propels fragments and debris at a high velocity up to 50 ft. on each side of the aircraft. All personnel must remain clear during canopy jettison. Personnel activating the canopy jettison handle must wear full protective clothing and eye protection to avoid serious injury.

a. Open access door, located on the nose of the aircraft directly in front of the CPG cockpit, rotate canopy jettison handle 90 degrees counterclockwise and push in to jettison canopy side panels.



ENGINE SHUTDOWN

1. NORMAL ENGINE SHUTDOWN

NOTE:
Normal engine shutdown can be accomplished only from the pilot's cockpit (aft).

WARNING

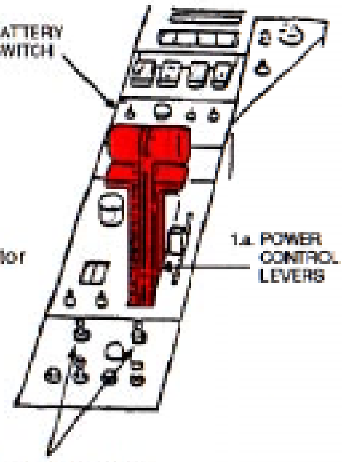
If emergency egress is required before the rotor blades have stopped, ensure cyclic remains centered. BATTERY and FORCE TRIM switches shall be left ON to prevent rotors from striking the aircraft or personnel.

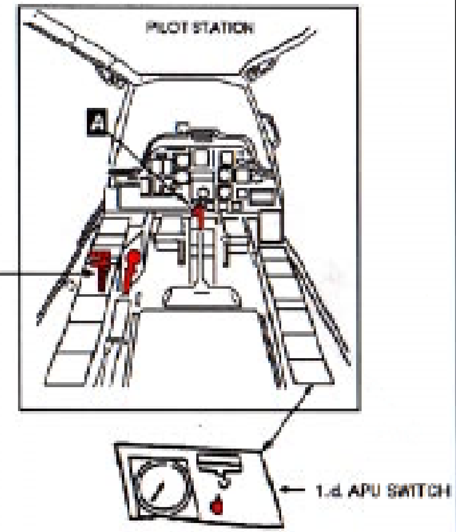
a. Pull power control levers, located on left console, aft to idle detent.

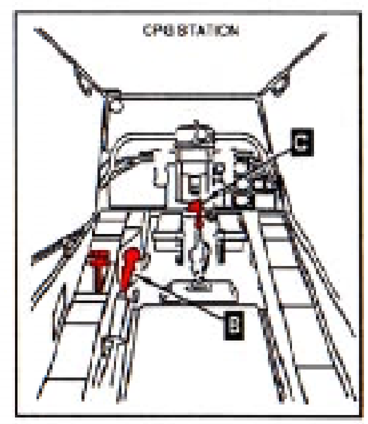
b. Place fuel switches, located on left console behind the power control levers, to OFF position.

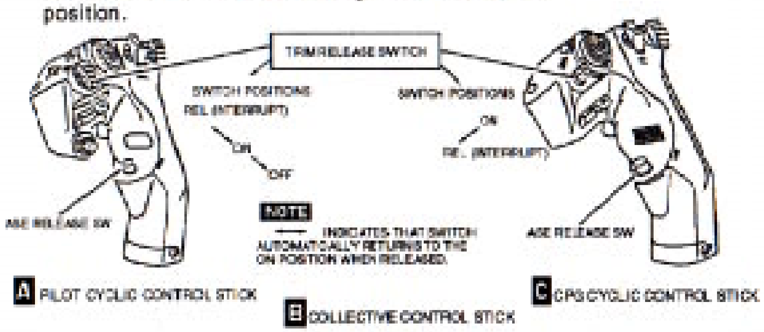
c. Place battery switch, located on left console in front of the power control levers, to OFF position.

d. Place APU switch, located on right console, to OFF position.









Pilot and CPG Collective and Cyclic Control Sticks

AH-64

ENGINE SHUTDOWN AND AIRCRAFT EXTRACTION

AH-64

2. EMERGENCY ENGINE SHUTDOWN

a. Pull engine fire **T**-handles, located on pilot's instrument panel.

b. Place engine fire extinguisher switch, located below the engine fire T-handles, to primary position.

NOTE:
The APU cannot be shutdown from the GCP cockpit (front).

WARNING

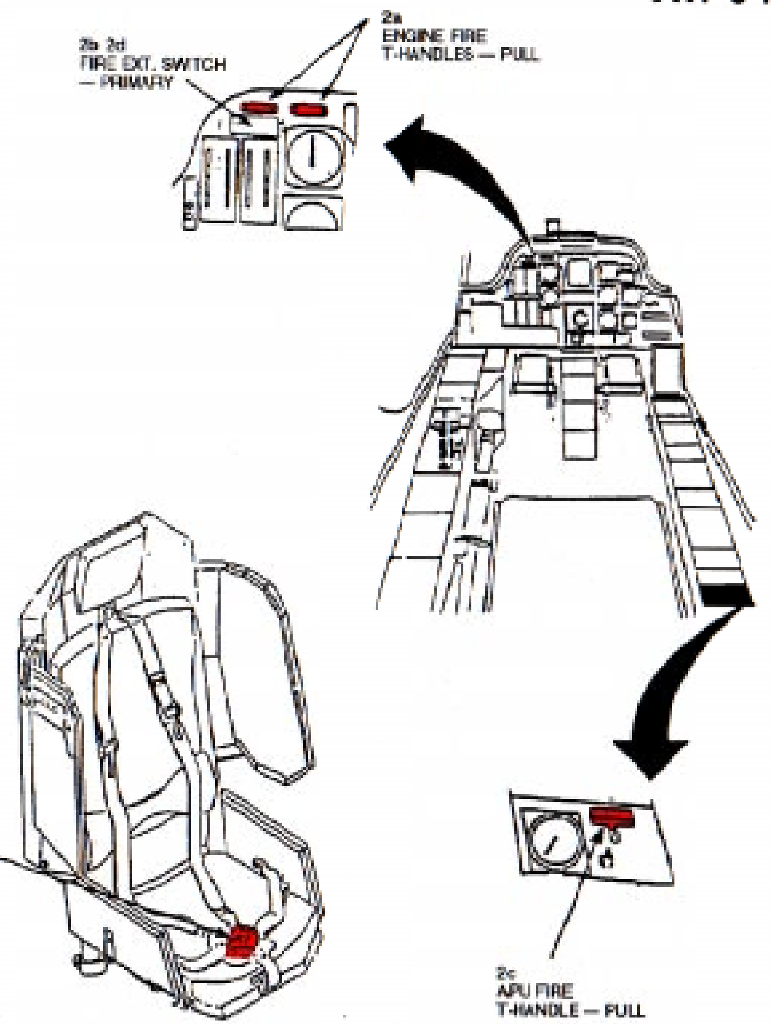
If emergency egress is required before the rotor blades have stopped, ensure cyclic remains centered. BATTERY and FORCE TRIM switches shall be left ON to prevent rotors from striking the aircraft or personnel. (See page 13-11 for locations.)

c. Pull APU fire T-handle, located on right console.

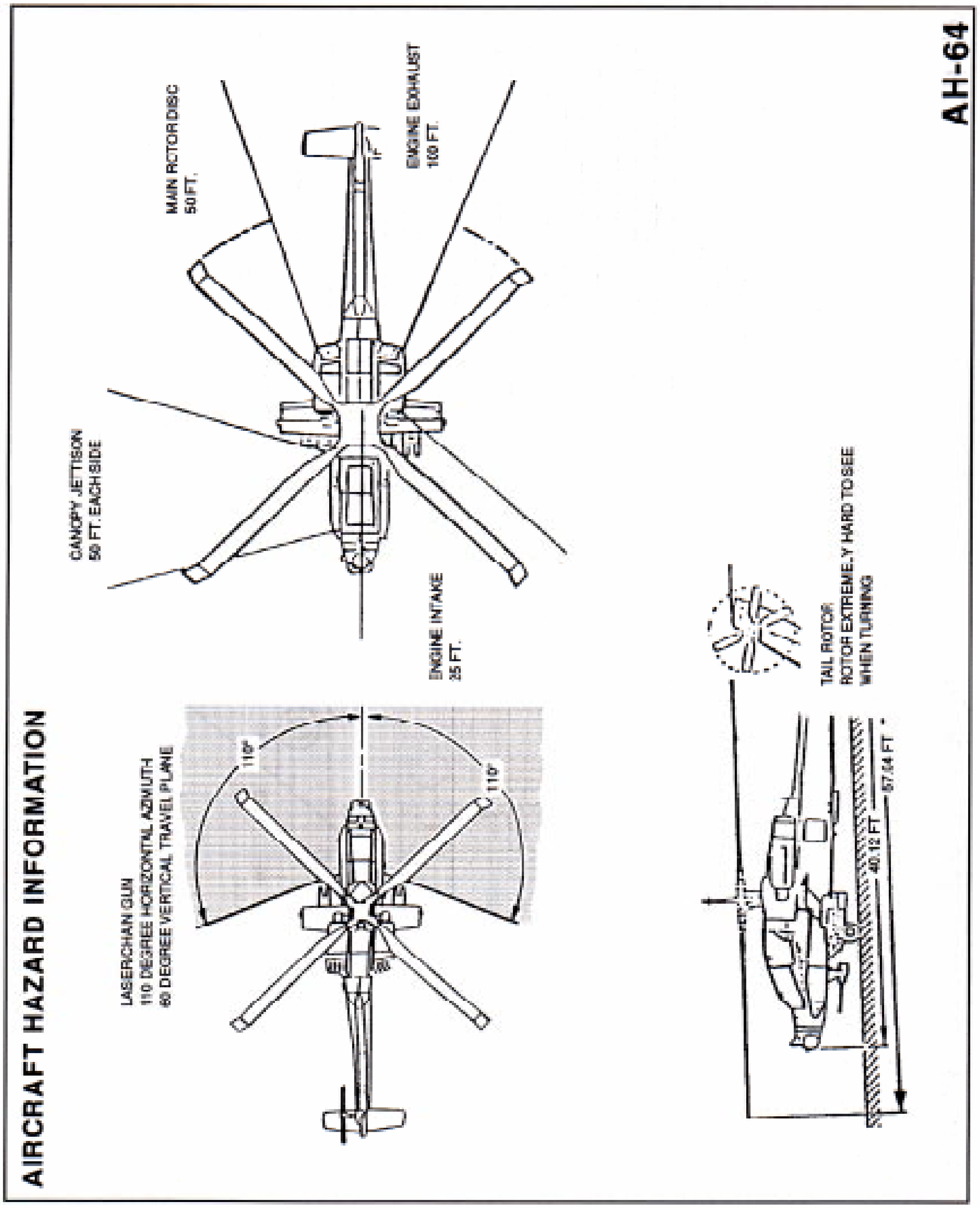
d. Place APU fire extinguisher switch, located behind the fire T-handle, to primary position.

3. AIRCREW EXTRACTION

a. Turn harness release knob 1/4 turn in either direction to release crewmember restraints.

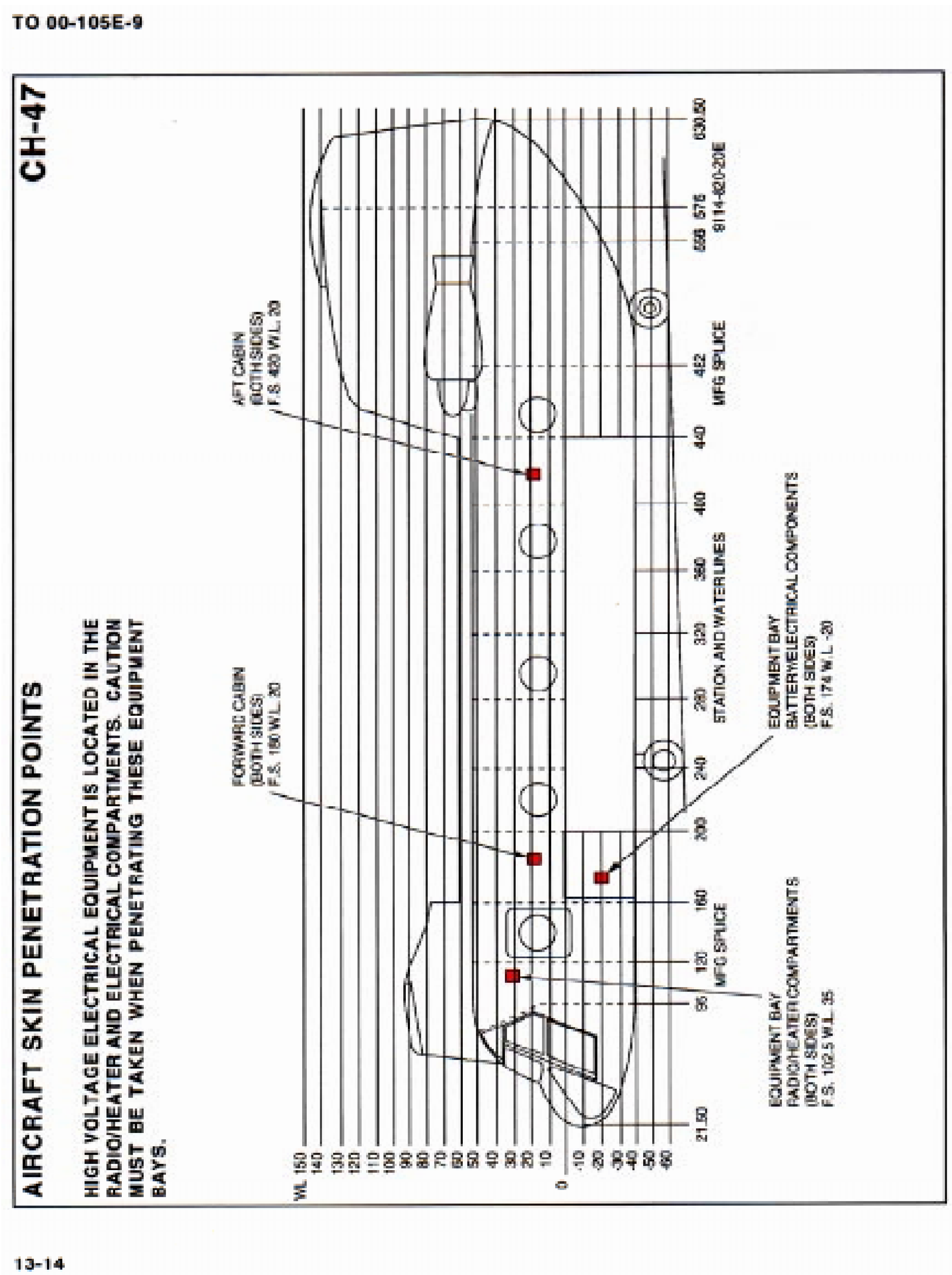


TO 00-105E-9

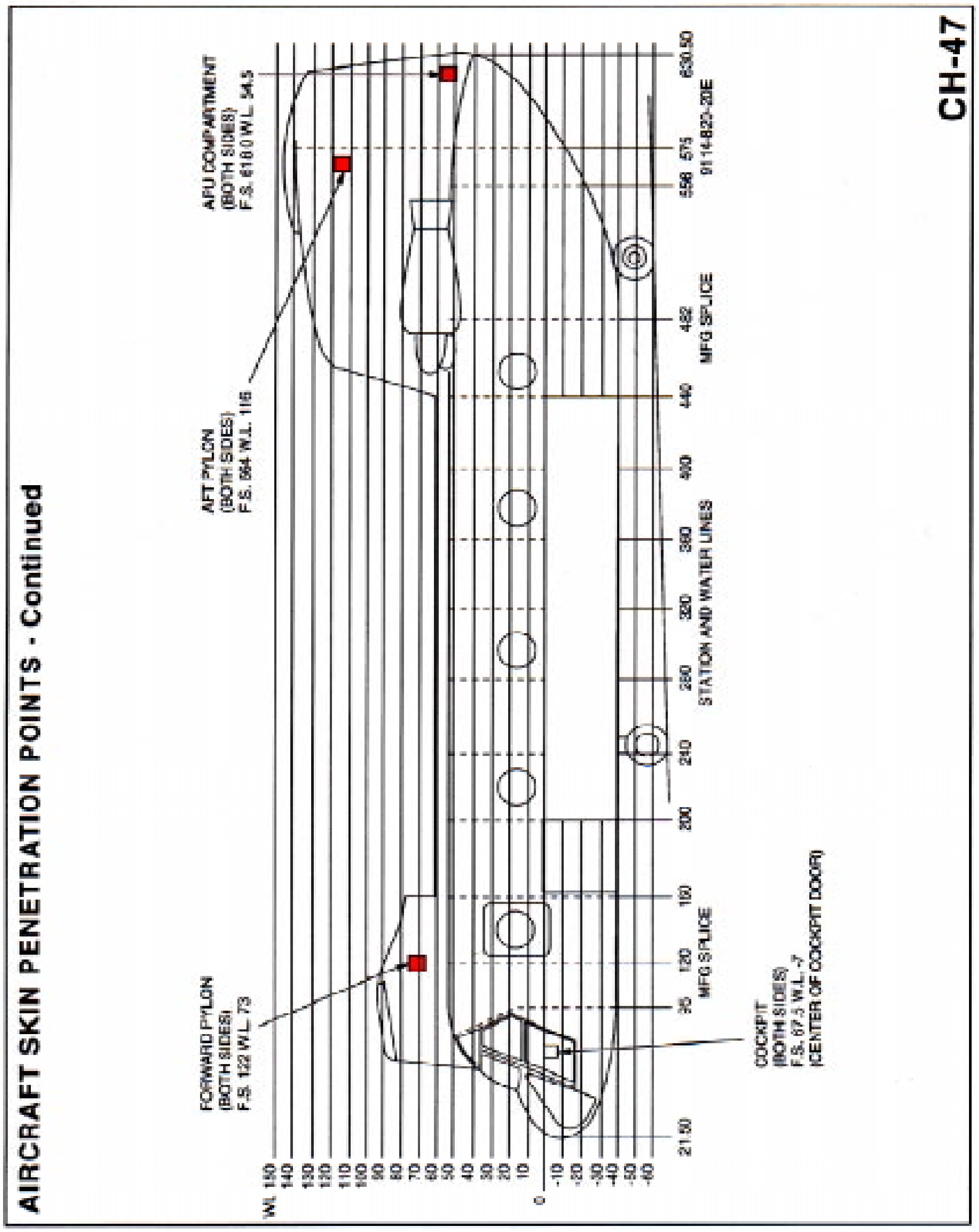


13-13

CH-47 Chinook



TO 00-105E-9



13-15

CH-47

SPECIAL TOOLS/EQUIPMENT
Power Rescue Saw
Disarming Tool

AIRCRAFT ENTRY ALL MODELS

1. NORMAL ENTRY

NOTE:
The pilot's and copilot's doors are jettisonable doors only. The cabin entrance door is a two section door. The upper half of the door rolls up, the lower half swings out and down forming a step.

a. Rotate handle, located on upper half of cabin door, roll door up.

b. Rotate handle, located on lower half of cabin door, pull door out and down.

2. EMERGENCY ENTRY

a. Push trigger button in center of handle and rotate emergency release handle, located below and aft of pilot's and copilot's jettisonable doors, pull door out.

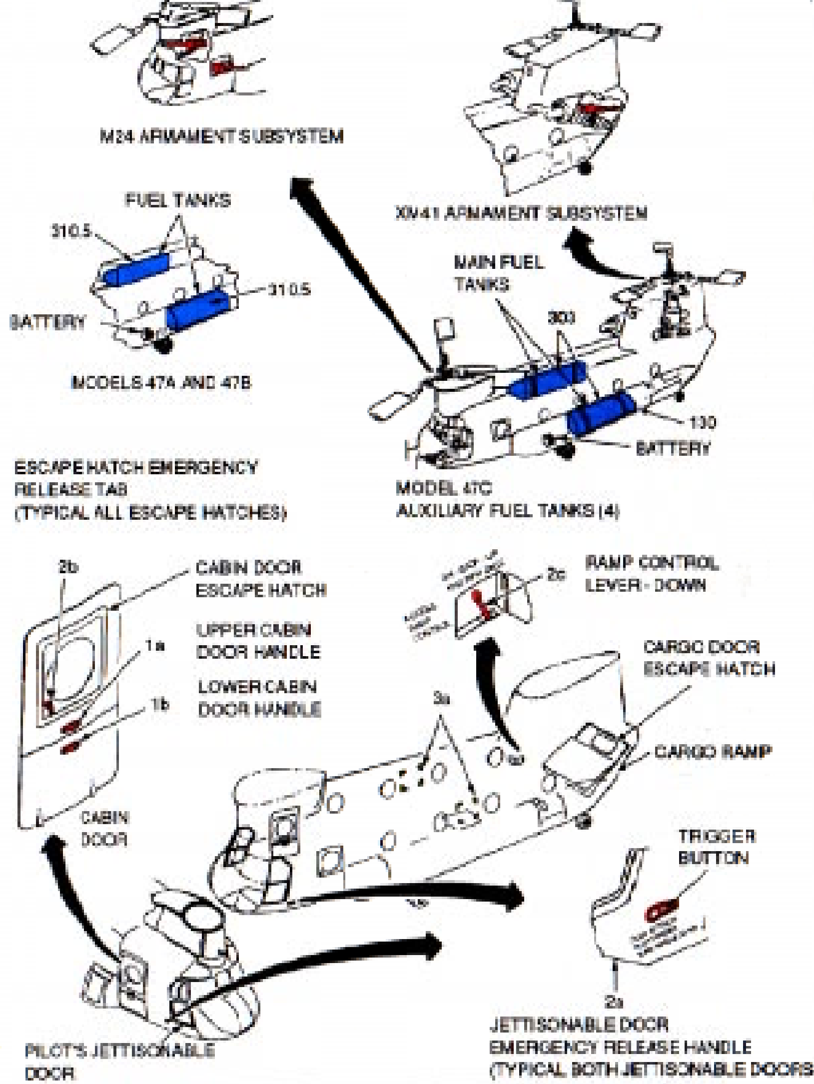
b. Pull emergency release tab in lower corner of escape hatches, located on upper cabin door, left forward of side of fuselage and cargo door out and push panels in.

NOTE:
Sufficient hydraulic pressure must be available to actuate cargo ramp uplocks. When uplocks are released, cargo ramp will free fall slowly.

c. Open ramp control access door, located aft right side of fuselage near ramp, place ramp control lever to DOWN position (aft).

3. CUT-IN

a. Cut-in areas as marked in center of upper fuselage between windows on both sides.



ENGINE SHUTDOWN AND AIRCREW EXTRACTION

1. NORMAL SHUTDOWN

a. Position engine condition levers, located on control pedestal or overhead switch panel, to STOP.

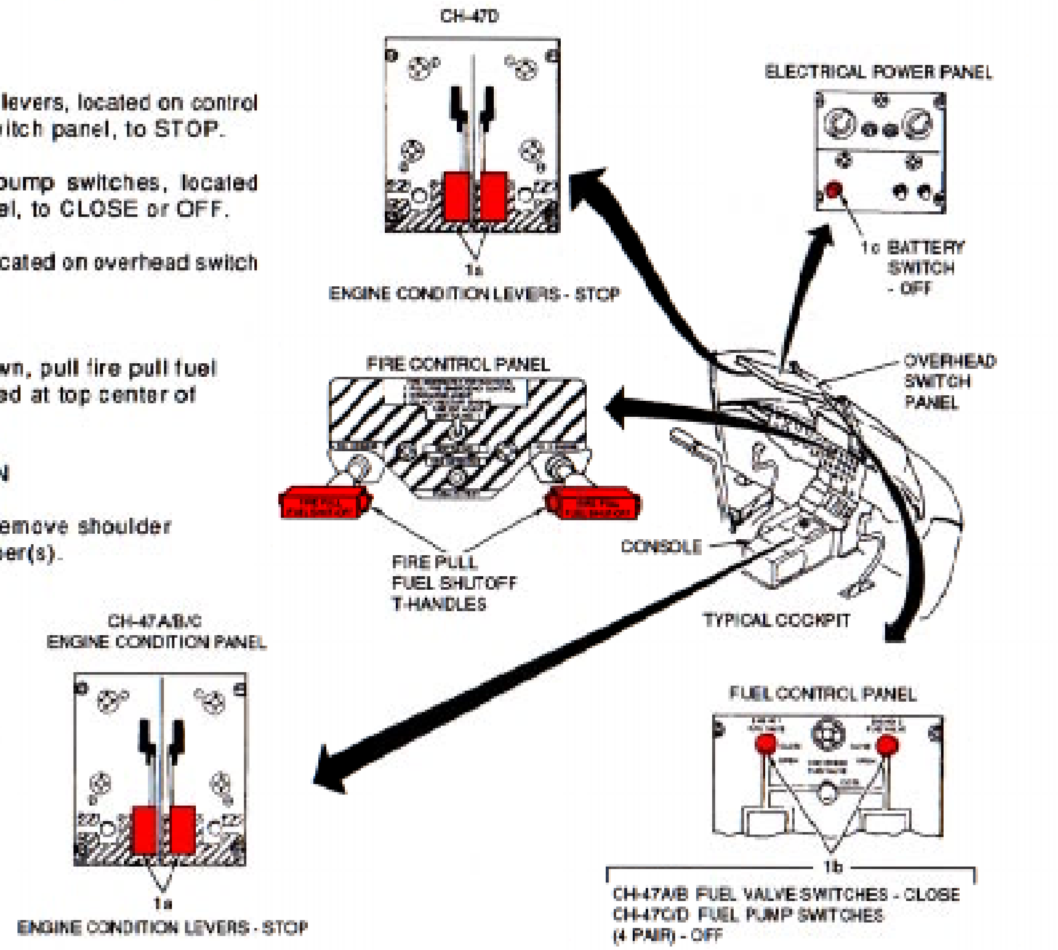
b. Position fuel valve or pump switches, located on overhead switch panel, to CLOSE or OFF.

c. Position battery switch, located on overhead switch panel, to OFF.

NOTE:
If engines fail to shutdown, pull fire pull fuel shutoff T-handles, located at top center of instrument panel, OUT.

2. AIRCREW EXTRACTION

a. Unlatch seat belts and remove shoulder harness from crewmember(s).



CH-47

CH-54 Tahre-Skycrane

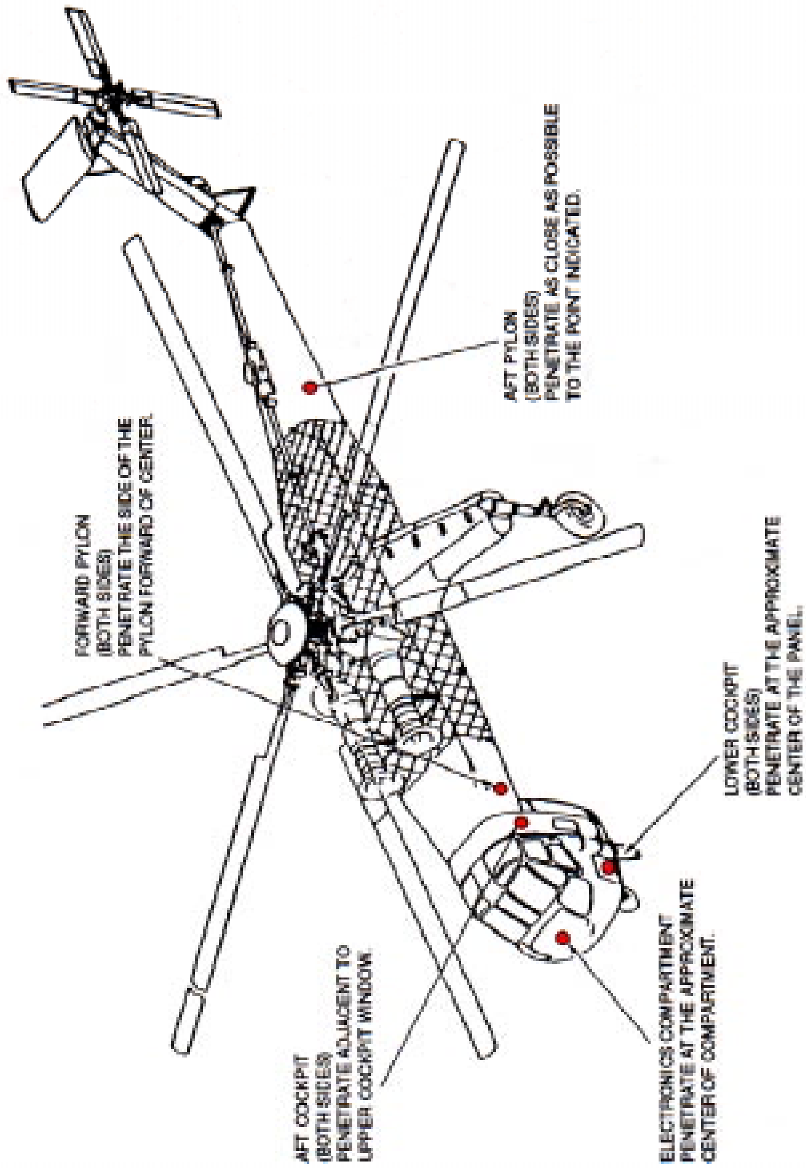
TO 00-105E-9

AIRCRAFT SKIN PENETRATION POINTS

CH-54

WARNING

Penetrate the forward and aft pylons cautiously. The area between the pylons contain fuel cells.



13-18

SPECIAL TOOLS/EQUIPMENT
Power Rescue Saw

AIRCRAFT ENTRY
ALL MODELS

1. NORMAL ENTRY

a. Rotate entrance handle, located on aft edge of pilot's and copilot's entrance door, swing door out.

b. Rotate entrance handle, located on aft edge of rear cockpit entrance door on right side of crew compartment, swing door out.

c. Rotate entrance handle, located on aft edge of pod access doors, swing door out.

2. EMERGENCY ENTRY

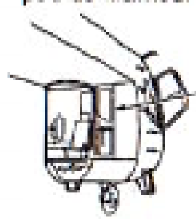
a. Rotate emergency jettison release handle, located at forward lower corner of pilot's and copilot's entrance door, pull door out.

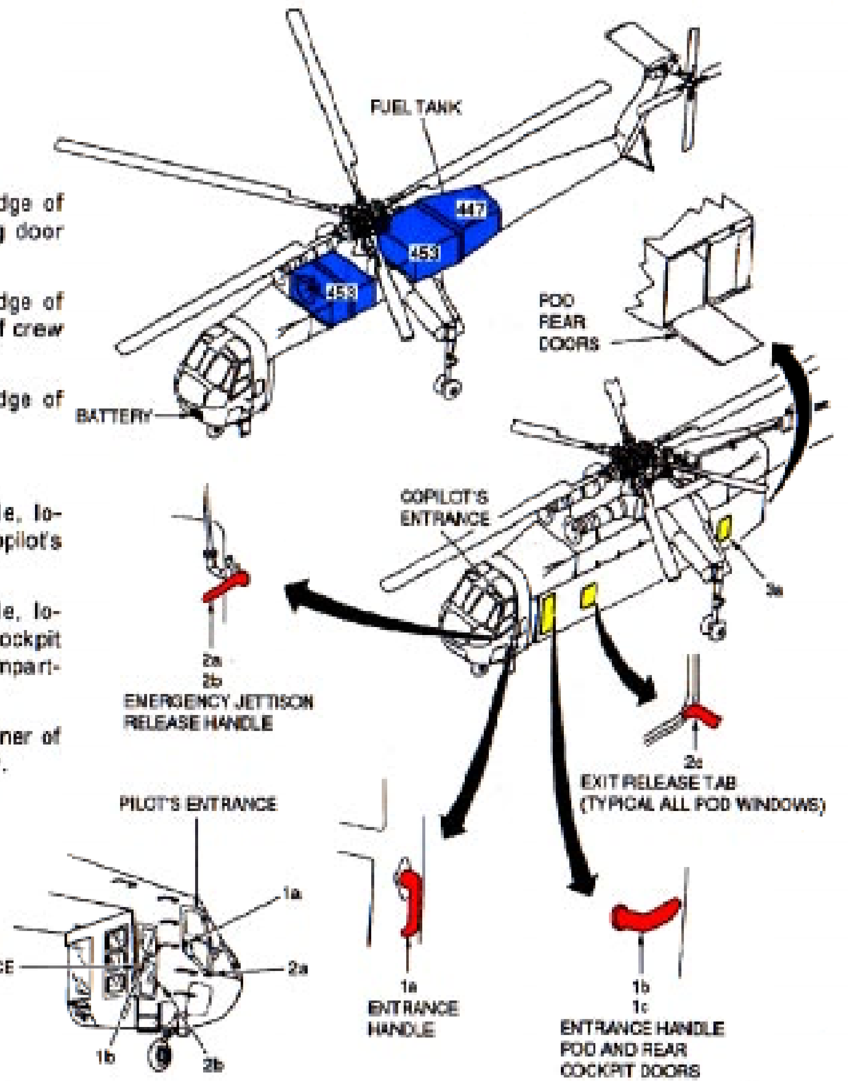
b. Rotate emergency jettison release handle, located at forward lower corner of rear cockpit entrance door on right side of crew compartment, pull door out.

c. Pull exit release tab, located lower aft corner of each pod window, cut and remove window.

3. CUT-IN

a. Cut around windows and access doors of pod as marked.





CH-54

ENGINE SHUTDOWN AND AIRCREW EXTRACTION

CH-54

1. ENGINE SHUTDOWN

NOTE:
NI levers have a detent in GRD IDLE position. To pass through the detent tc SHUTOFF position, pull out on levers.

a. Place N1 levers, located on overhead control quadrant, to SHUTOFF position.

b. Place fuel valve shutoff handle, located on overhead control quadrant, in CLOSED position.

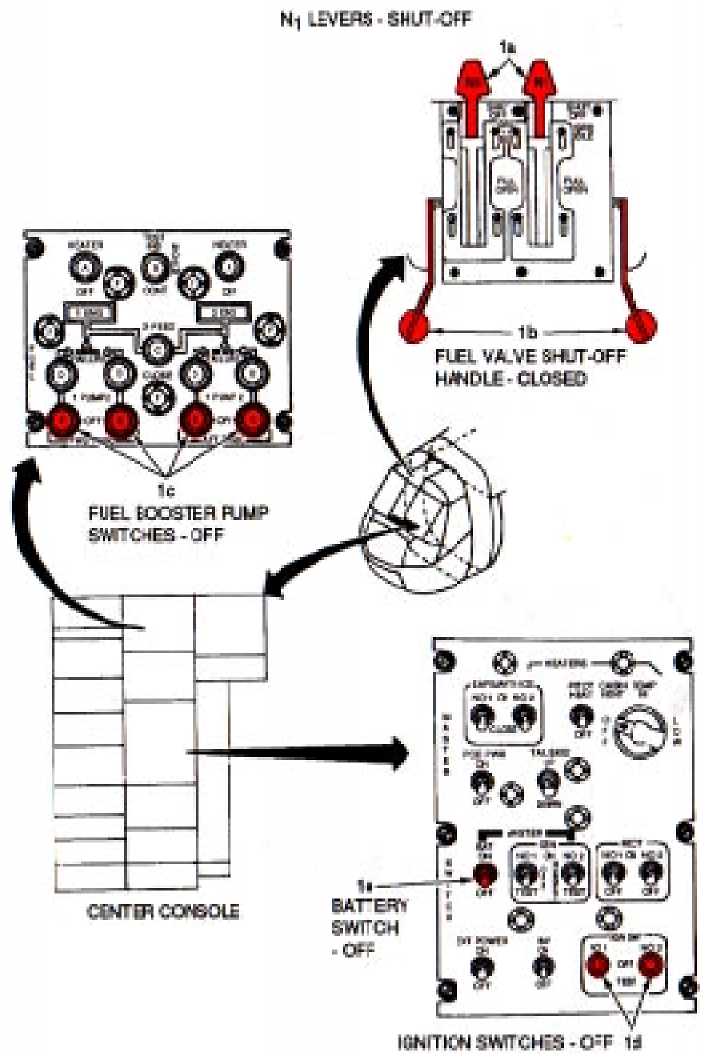
c. Place fuel booster pump switches, located in upper panel of center console, to OFF position.

d. Place ignition switches, located in center panel center console, tc OFF position.

e. Place battery switch, located in center panel of center console, tc OFF position.

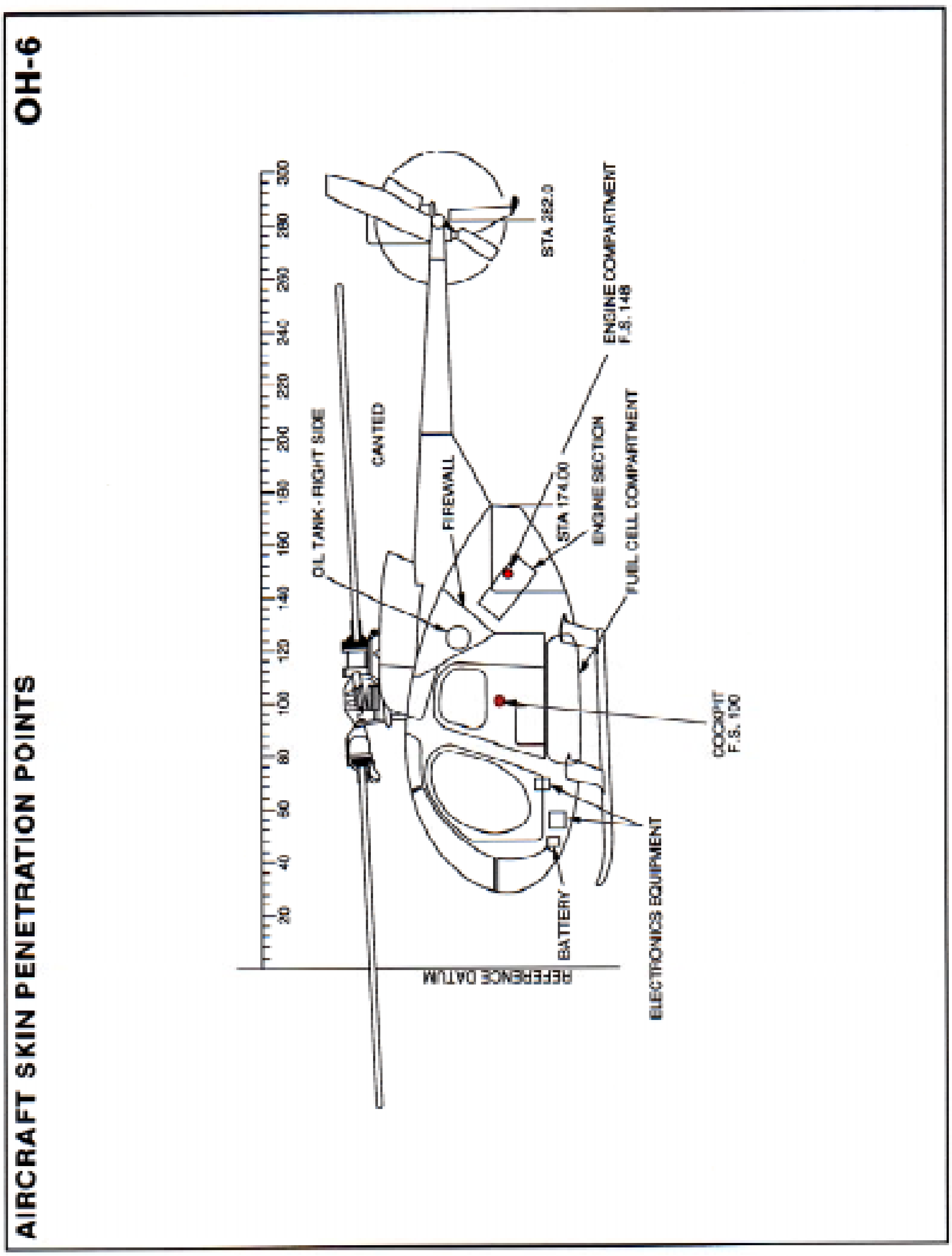
2. AIRCREW EXTRACTION

a. Unlatch lap belts and remove shoulder harness from crewmember(s).



OH-6 Cayuse

TO 00-105E-9



13-22

SPECIAL TOOLS/EQUIPMENT
Power Rescue Saw
Crash Axe

AIRCRAFT ENTRY
ALL MODELS

1. NORMAL/EMERGENCY ENTRY

WARNING

Any rotation of gun barrels will cause gun to fire.

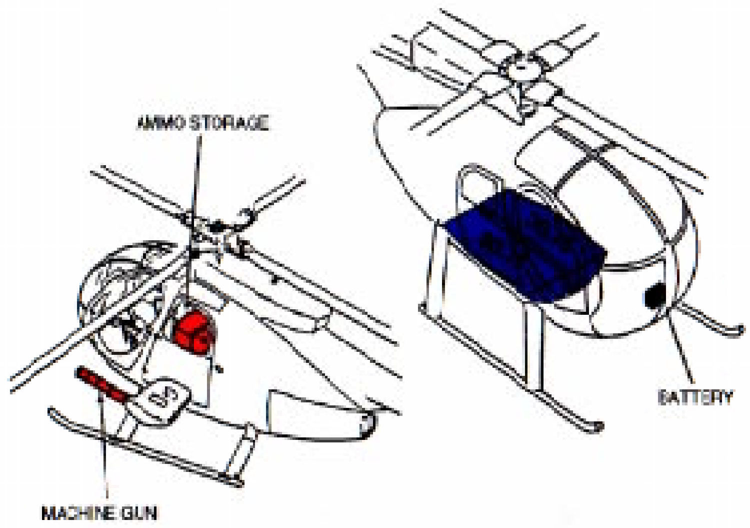
NOTE:
Four doors are located two on each side of fuselage. Entry procedures are basically identical for each door.

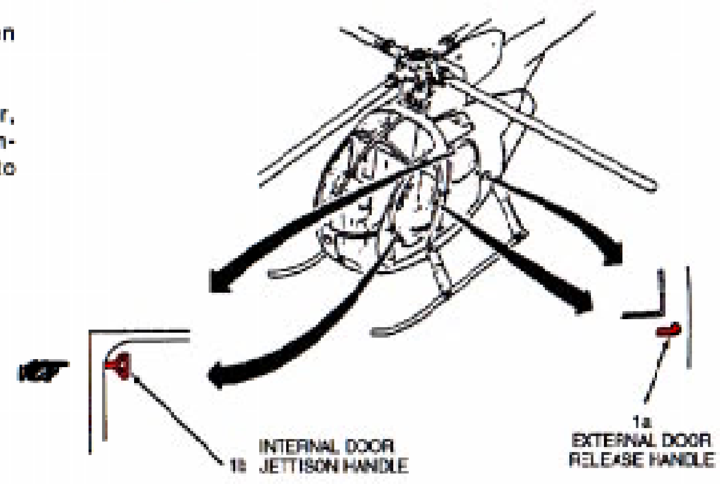
a. Rotate external door release handle and open door.

b. If external release handle does not open door, leave handle in open position, break door window, and pull internal door jettison handle to disengage hinge pins.

2. CUT-IN

a. Cut cabin enclosure as required.





OH-6

ENGINE SHUTDOWN AND AIRCREW EXTRACTION

OH-6

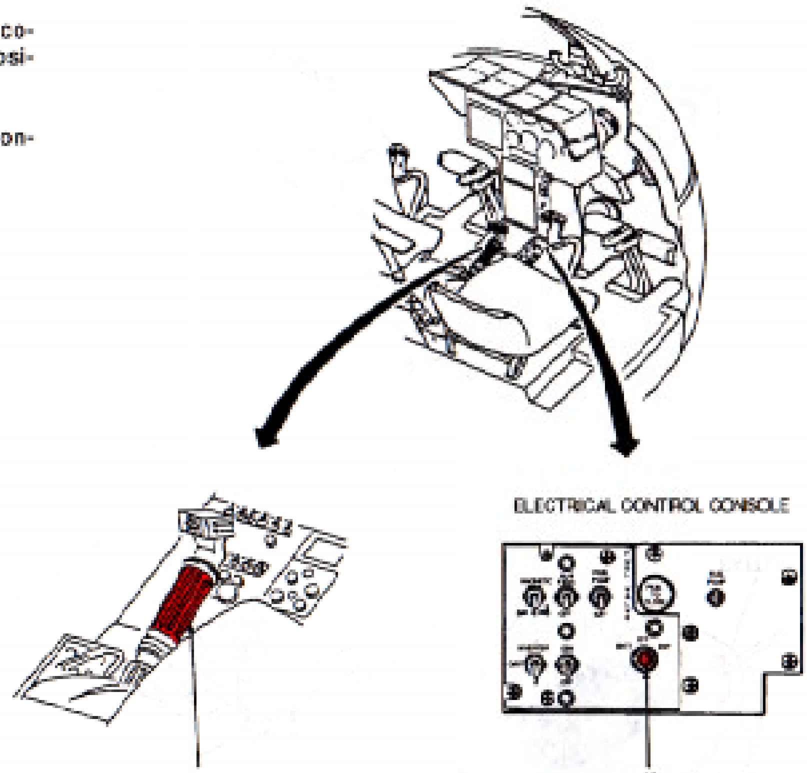
1. ENGINE SHUTDOWN

a. Rotate throttle control, located on pilot and co-pilot collective levers, to FUEL CUTOFF position.

b. Place battery switch, located on electrical control console, to OFF position.

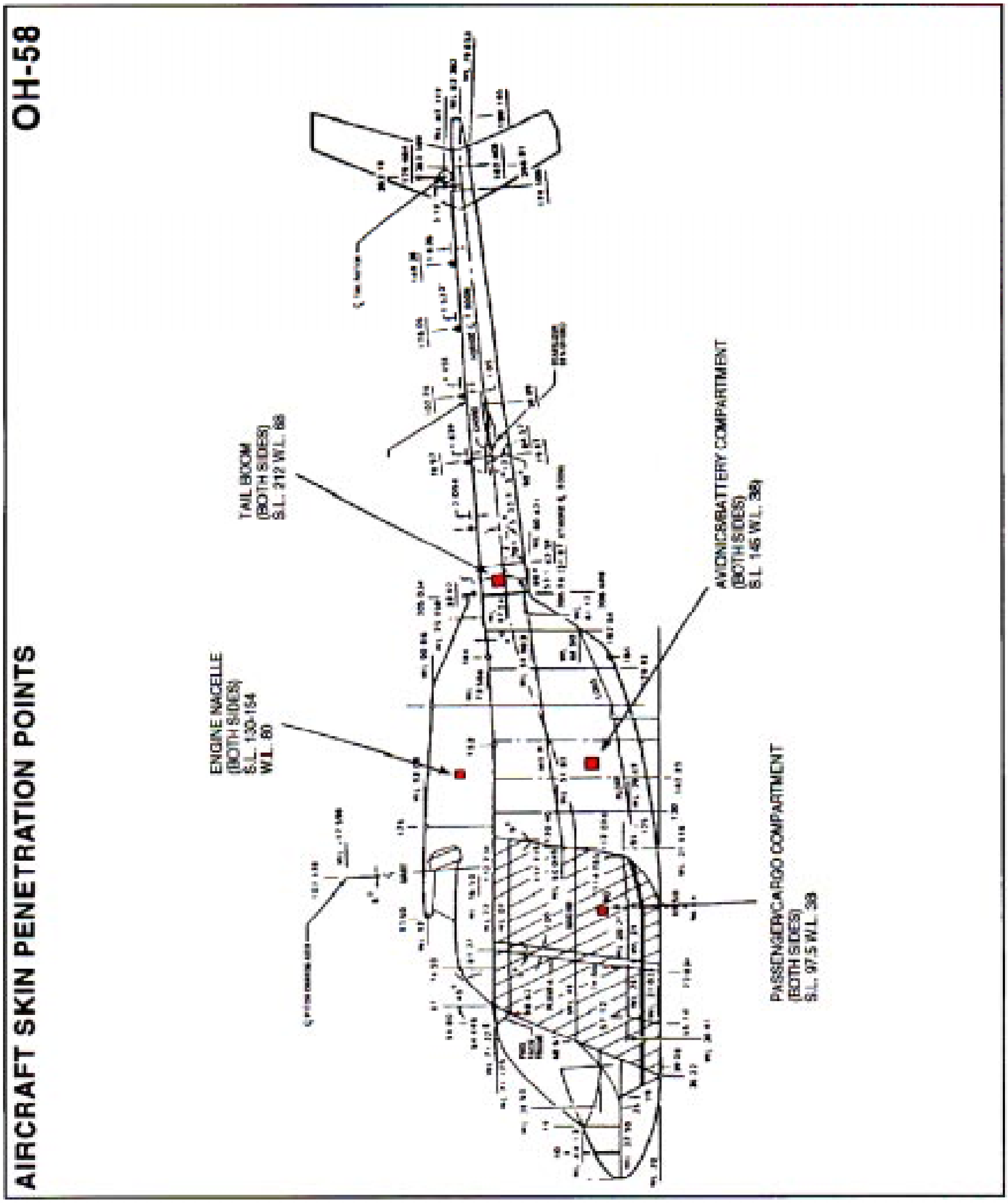
2. AIRCREW EXTRACTION

a. Unlatch lap belt and remove shoulder harness from crewmember(s).



OH-58 Kiowa

TO 00-105E-9



13-26

SPECIAL TOOLS/EQUIPMENT
Power Rescue Saw

AIRCRAFT ENTRY
ALL MODELS

WARNING

Any rotation of gun barrel will cause gun to fire.

1. NORMAL ENTRY

a. Rotate door handles, located on aft edge of each door, swing doors forward.

2. EMERGENCY ENTRY

a. Cut windows in crew doors.

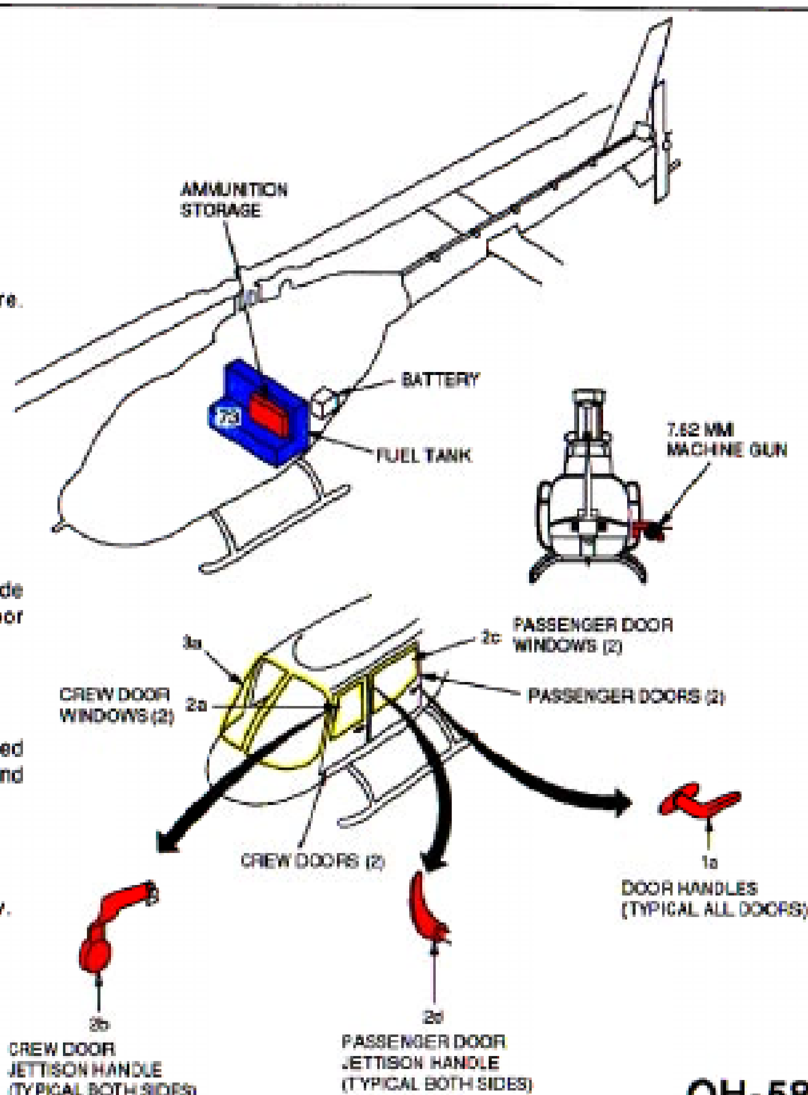
b. Pull crew door jettison handles, located inside on crew door forward support, aft and pull door out.

c. Cut windows in passenger doors.

d. Rotate passenger door jettison handles, located inside on passenger door forward support, and pull door out.

3. CUT-IN

a. Cut-in windows and windshields as necessary.



OH-58

ENGINE SHUTDOWN AND AIRCREW EXTRACTION

OH-58

1. ENGINE SHUTDOWN

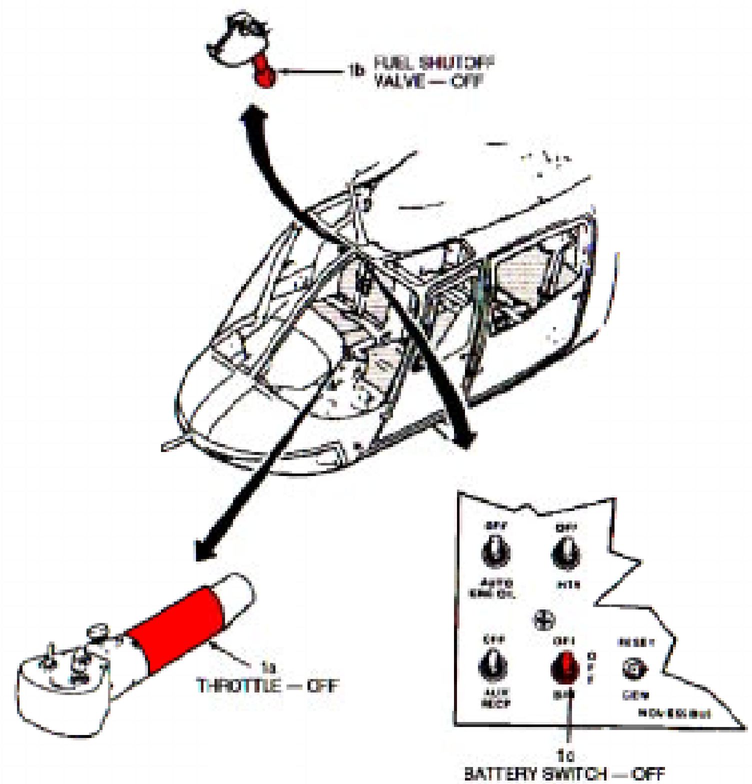
a. Rotate throttle, located on pilot's collective pitch stick, to OFF position.

b. Pull fuel shutoff valve, located overhead in crew compartment, aft to OFF position.

c. Place battery switch, located on overhead switch panel, in OFF position.

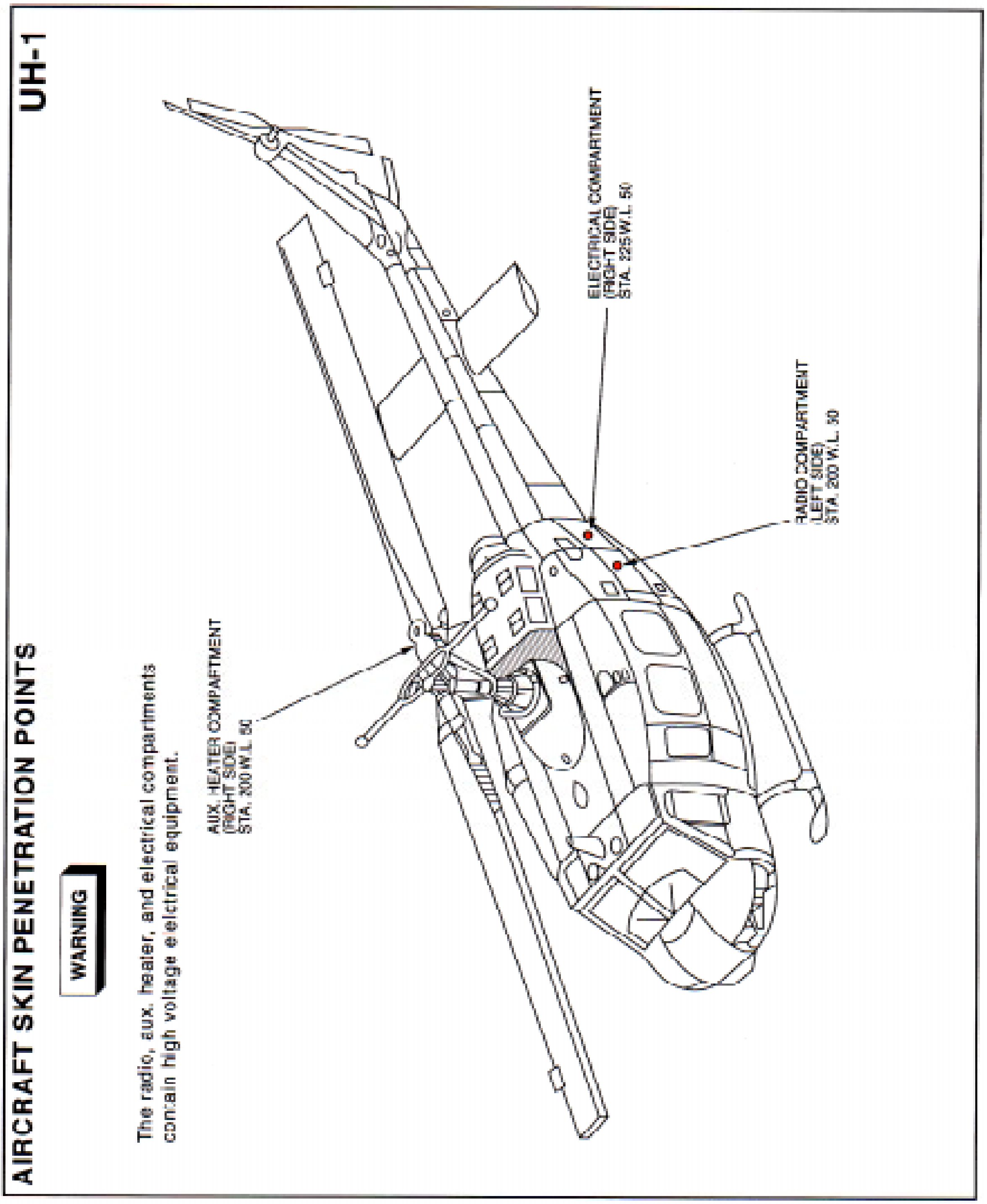
2. AIRCREW EXTRACTION

a. Unlatch lap belts and remove shoulder harness from crewmember(s).

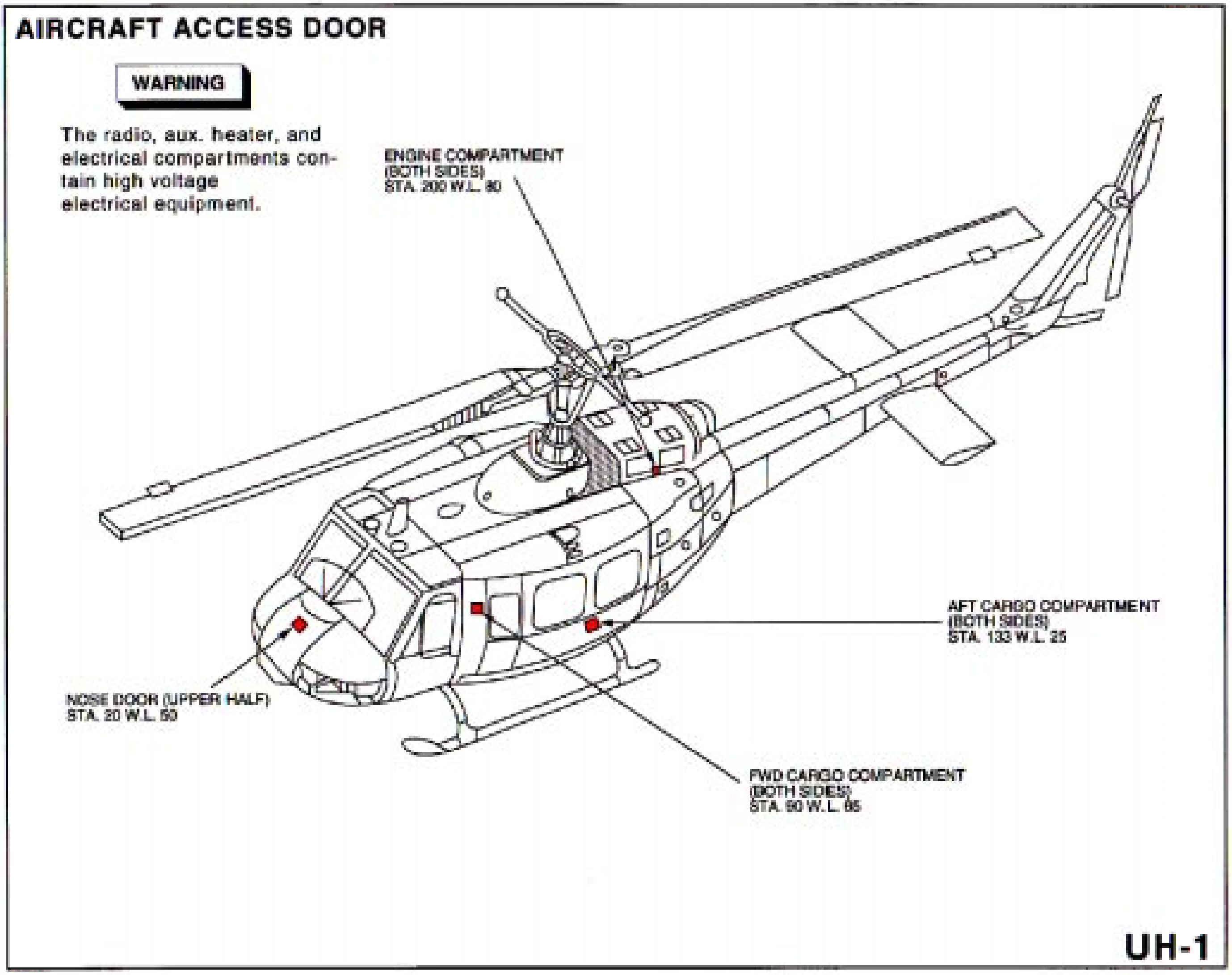


UH-1 Iroquois

TO 00-105E-9



13-32


AIRCRAFT ACCESS DOOR
WARNING
The radio, aux. heater, and electrical compartments contain high voltage electrical equipment.
ENGINE COMPARTMENT
(BOTH SIDES)
AFT CARGO COMPARTMENT
(BOTH SIDES)
STA. 133 W.L. 25
NOSE DOOR (UPPER HALF)
STA. 20 W.L. 50
FWD CARGO COMPARTMENT
(BOTH SIDES)
UH-1

SPECIAL TOOLS/EQUIPMENT
Power Rescue Saw

UH-1

AIRCRAFT ENTRY ALL MODELS

NOTE:
UH-1N and HH-1H fuel tank differences:

UH-1N - Has aft auxiliary fuel tanks.
HH-1H - Has fwd auxiliary fuel tanks.
Both have left and right bay fuel tanks for ferry missions.
HH-1H - Has 3 fuel cells across fuselage - 206 gal. total.
2 fuel cells below cabin floor - 300 gal. total.

WARNING

Caution must be exercised when entering rotor blade area. Entry must be from side of aircraft.

1. NORMAL ENTRY

a. Rotate crew door handle, located left and right forward fuselage, down to unlatch door. Pull out and forward to open position.

b. Rotate passenger-cargo door handle, located left and right fuselage, down to unlatch and release door. Slide door aft to open position.

2. EMERGENCY ENTRY

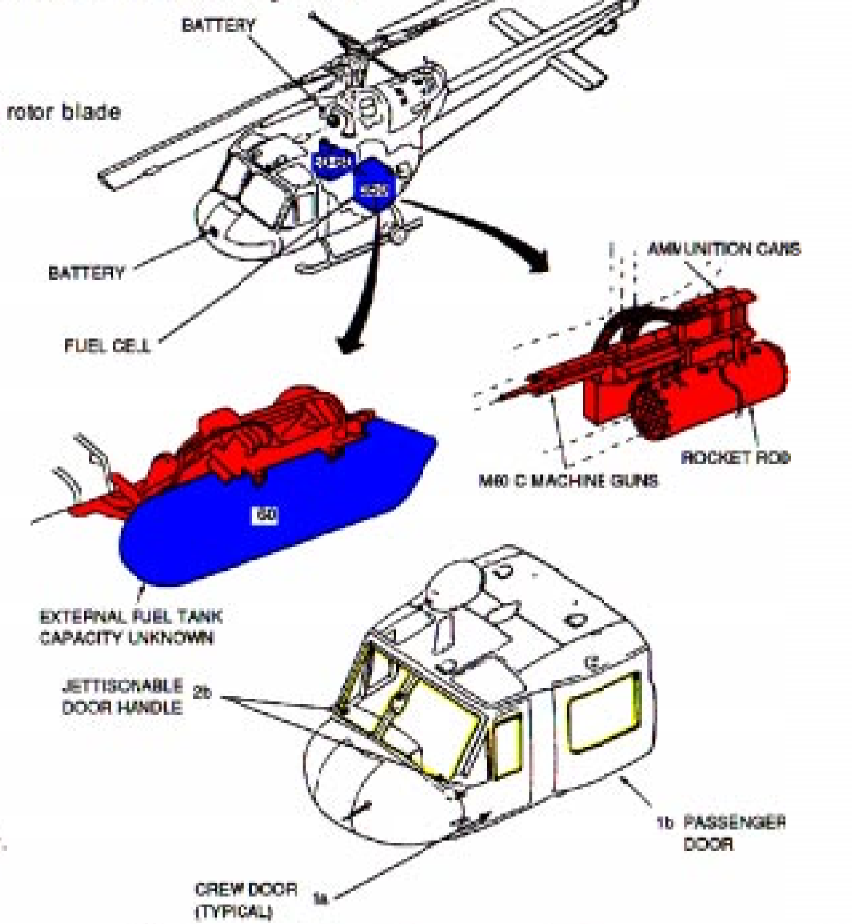
a. Slide, break or cut crew door window, located left and right forward fuselage.

b. Pull jettison handles, located forward of right and left crew door frames, aft to jettison doors.

c. Pull doors outward.

3. CUT-IN

a. Cut windows and windshield to gain entry.



ENGINE SHUTDOWN AND AIRCREW EXTRACTION

1. ENGINE SHUTDOWN

a. Pull fire pull T-handles, located upper center instrument panel. (UH-1N only)

b. Place fuel switches, located on pedestal console, to OFF position.

WARNING

Do not apply rotor brake above 130 RPM. Doing so could cause brake disc failure resulting in uncontrolled movement of the aircraft or disintegration of the brake disc. Application of the rotor brake when the aircraft is on ice may also result in uncontrolled movement.

c. Apply rotor brake (if installed), located overhead on right side of cabin roof, down and forward to lock.

d. Turn battery switch to OFF position.

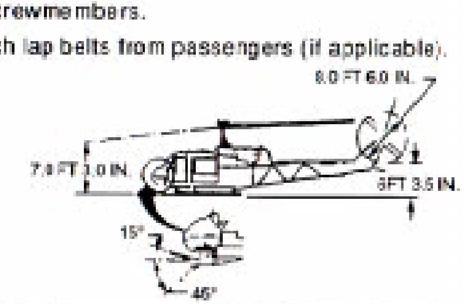
2. AIRCREW EXTRACTION

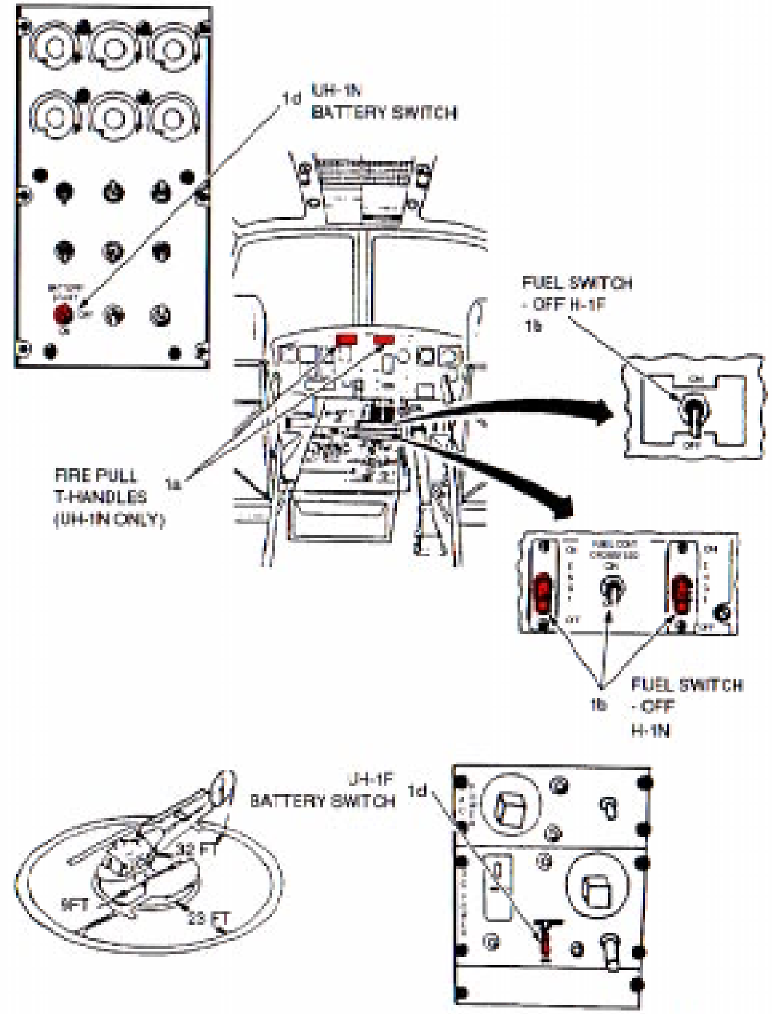
NOTE:

Aircrew seats are equipped with shoulder harness and lap belts. Troop seats are equipped with lap belts only.

a. Unlatch lap belts and remove shoulder harness from crewmembers.

b. Unlatch lap belts from passengers (if applicable).

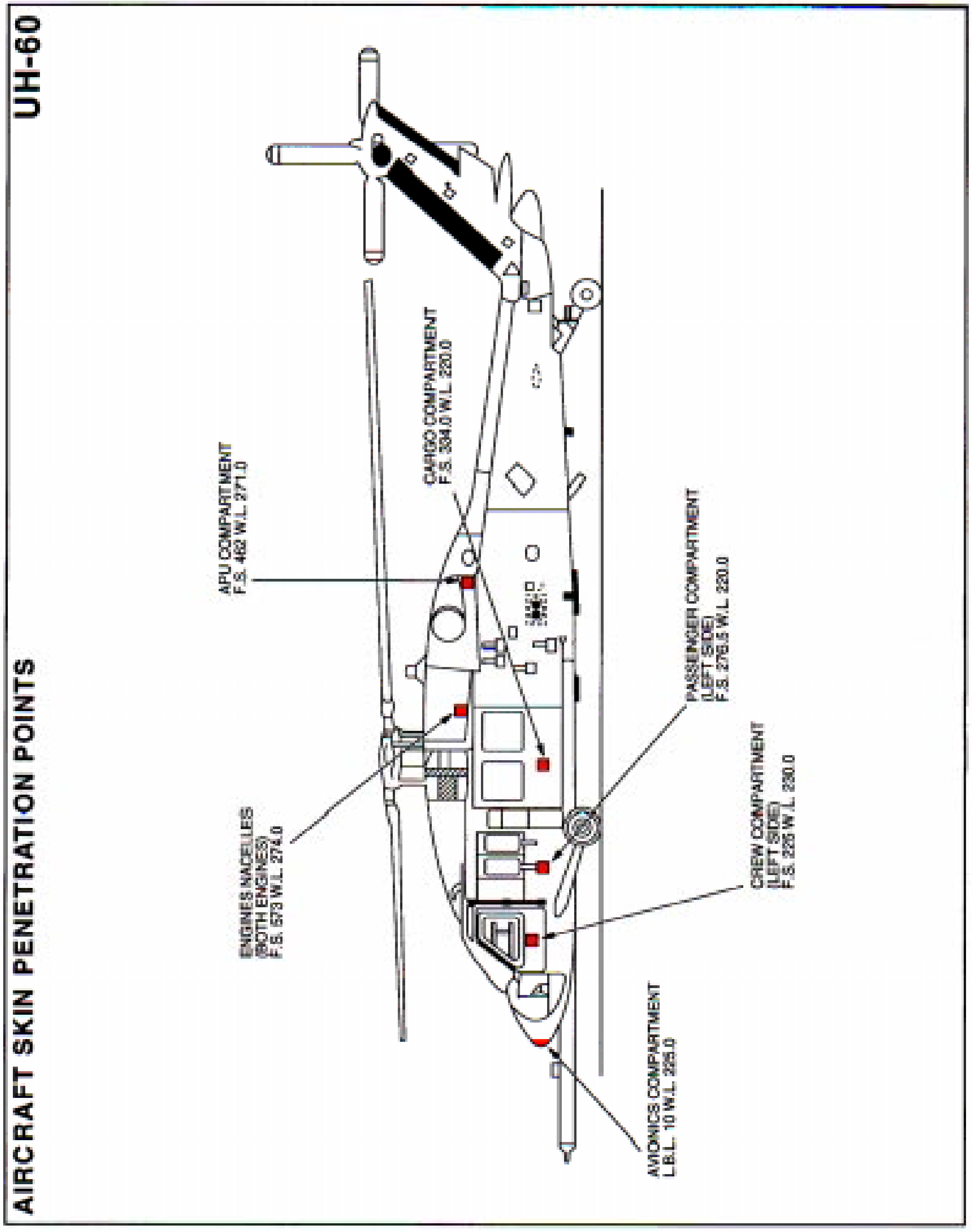




UH-1

UH-60 Blackhawk

TO 00-105E-9



13-36

UH-60A

SPECIAL TOOLS/EQUIPMENT
Power Rescue Saw
Crash Axe

AIRCRAFT ENTRY ALL MODELS

1. NORMAL ENTRY

a. Turn cockpit door handle counterclockwise to the open position to open door.

b. Turn cabin door handle counterclockwise to the open position and slide door aft.

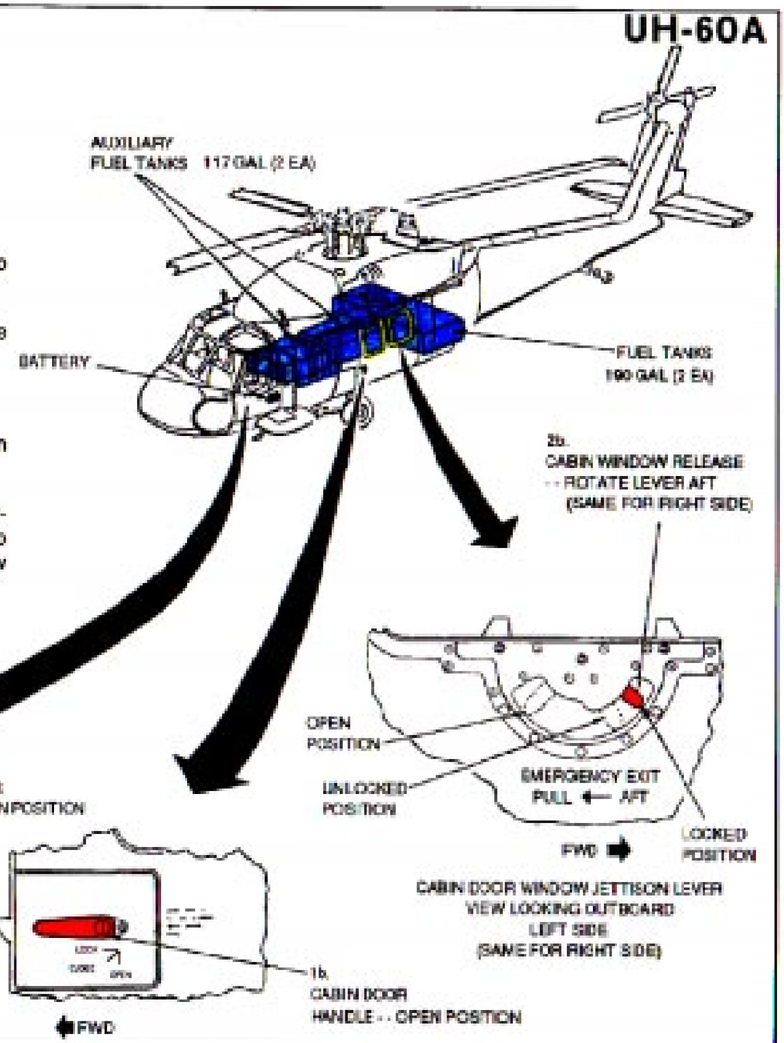
2. EMERGENCY ENTRY

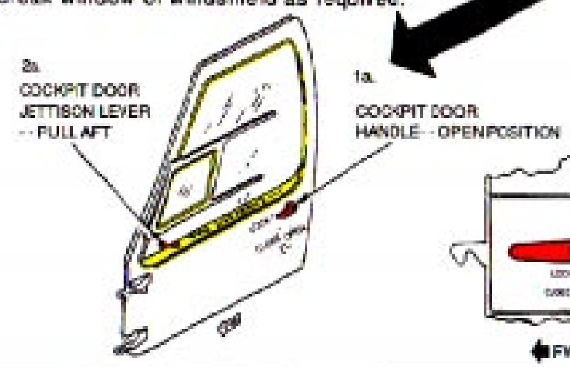
a. Break window in cockpit door and pull jettison lever aft to release door hinges.

b. Break window in cabin door and rotate emergency handle, located below each window, to the aft open position. Rotate bottom of window out to remove window.

3. CUT-IN

a. Break window or windshield as required.





ENGINE SHUTDOWN AND AIRCREW EXTRACTION

1. ENGINE SHUTDOWN

NOTE:
To activate the installed fire extinguishing system, one T-handle must be pulled (agent is discharged to last T-handle pulled). Then reposition the fire extinguisher switch from OFF to MAIN or RESERVE. Battery switch must be in the ON position.

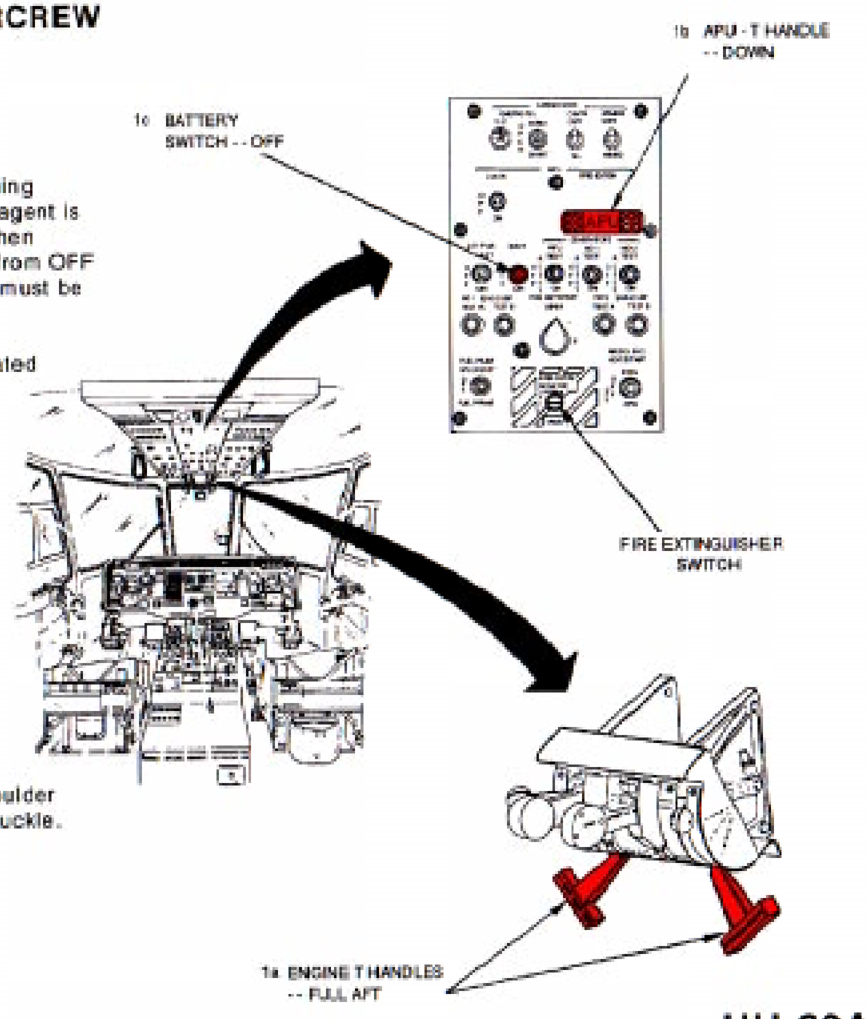
a. Pull engine emergency T-handles, located on control quadrant, FULL AFT.

b. Pull APU T-handle, located on upper console, DOWN.

c. Place battery switch, located on upper console, to the OFF position.

2. AIRCREW --TROOP EXTRACTION

NOTE:
- All aircrew seats have a complete lap belt and dual torso restraint shoulder harness attached to a rotary release buckle.
- All troop seats have a lap belt and shoulder harness attached to a rotary release buckle.

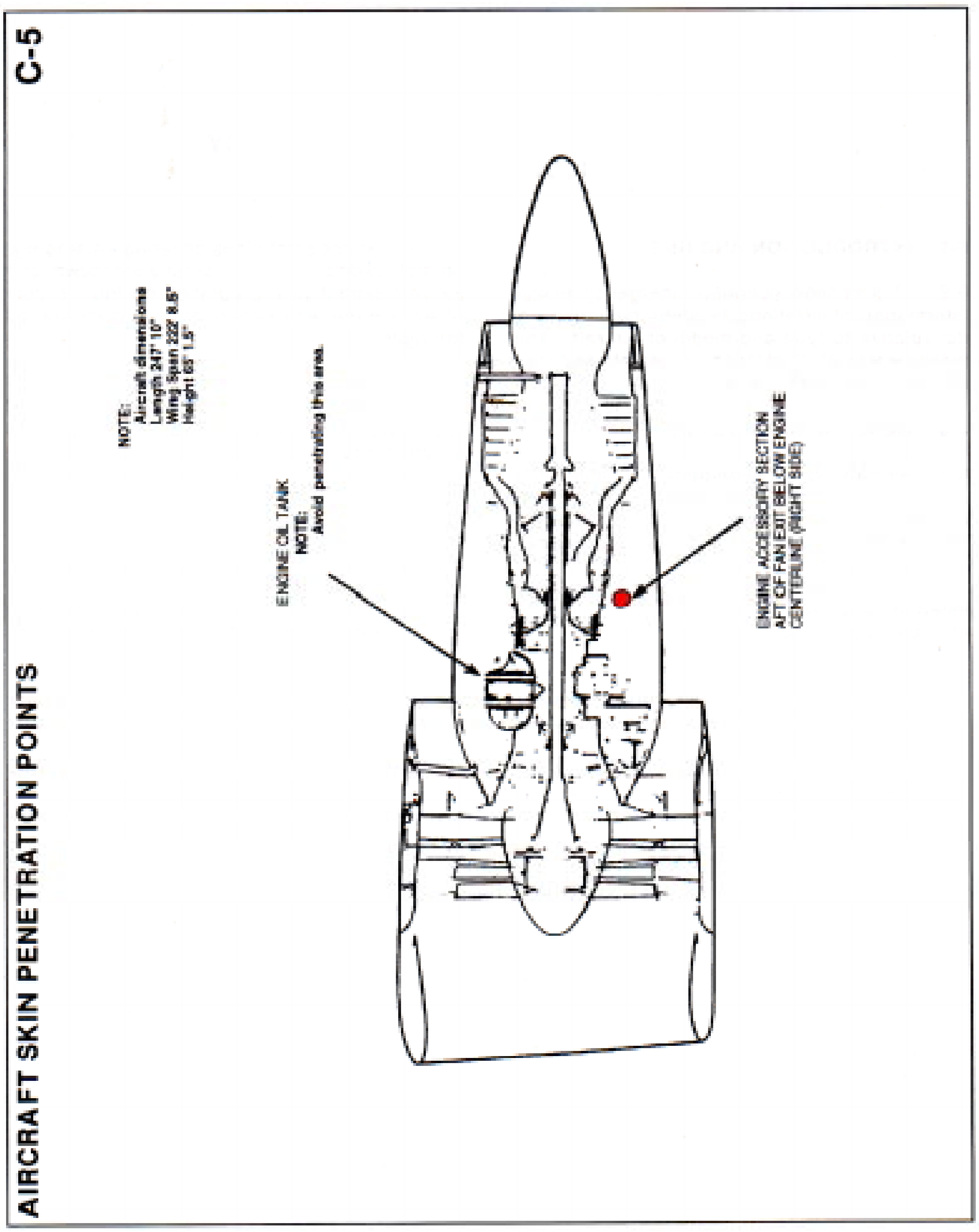


UH-60A

FIXED-WING AIRCRAFT

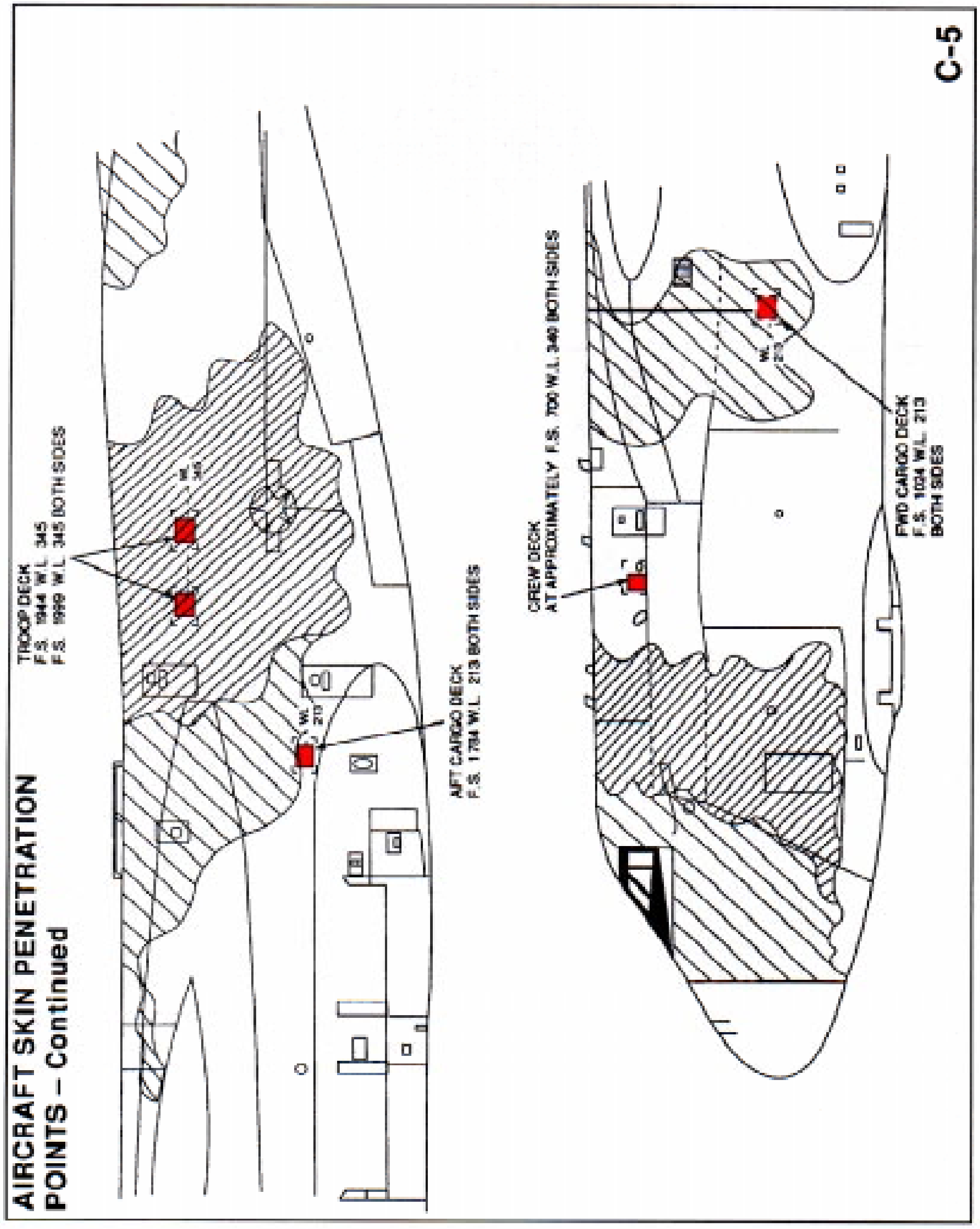
C-5 Galaxy

TO 00-105E-9



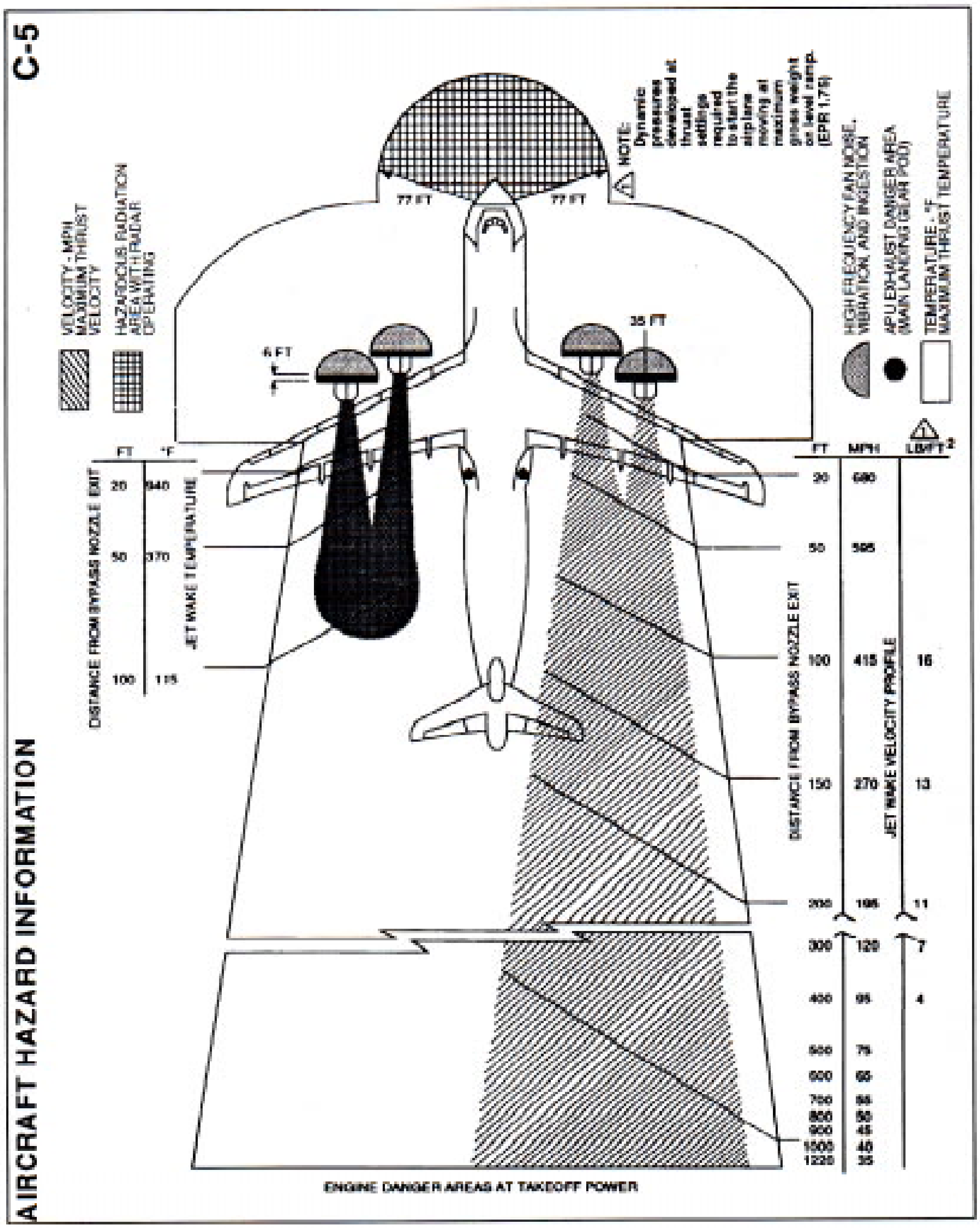
6-2

TO 00-105E-9



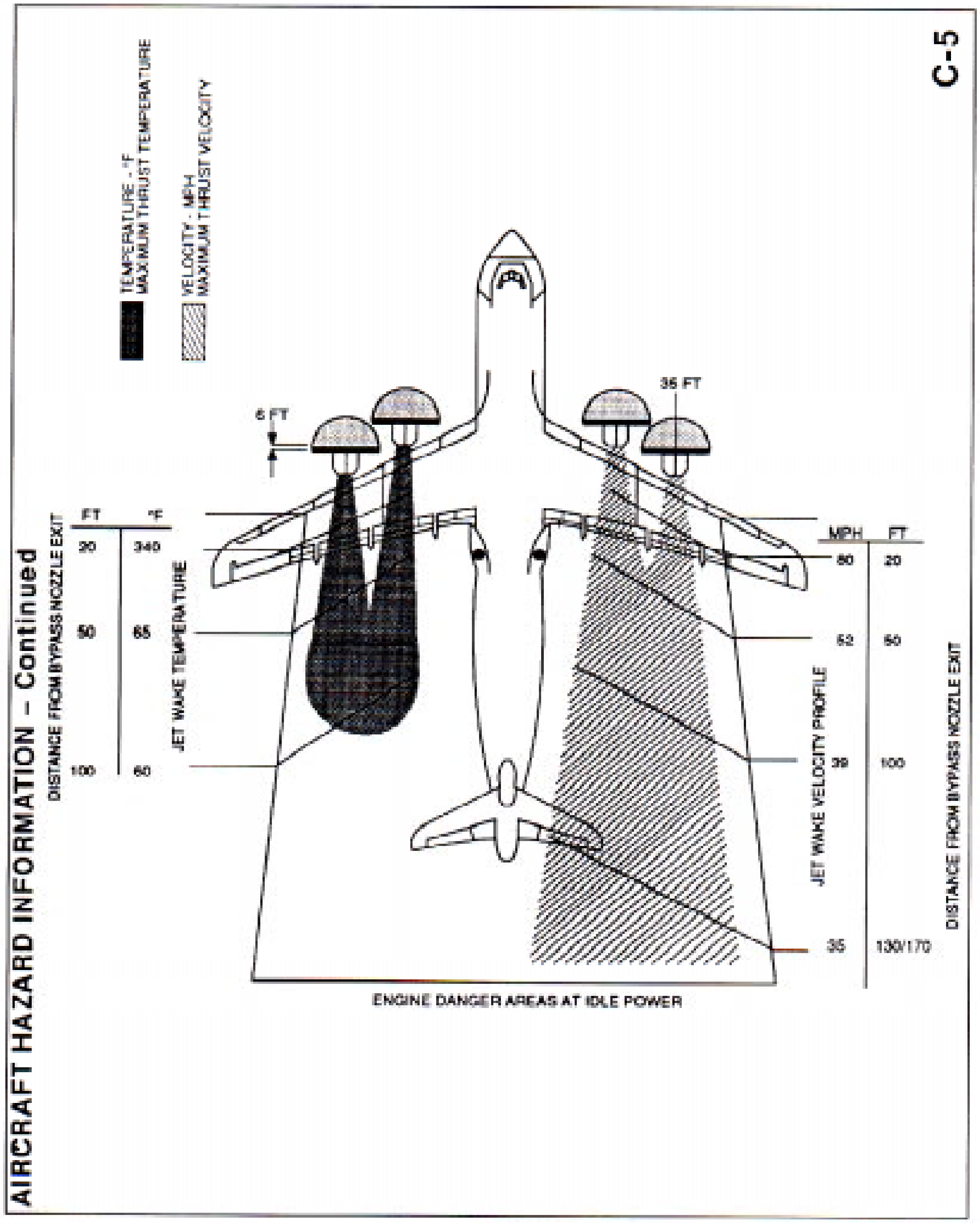
6-3

TO 00-105E-9



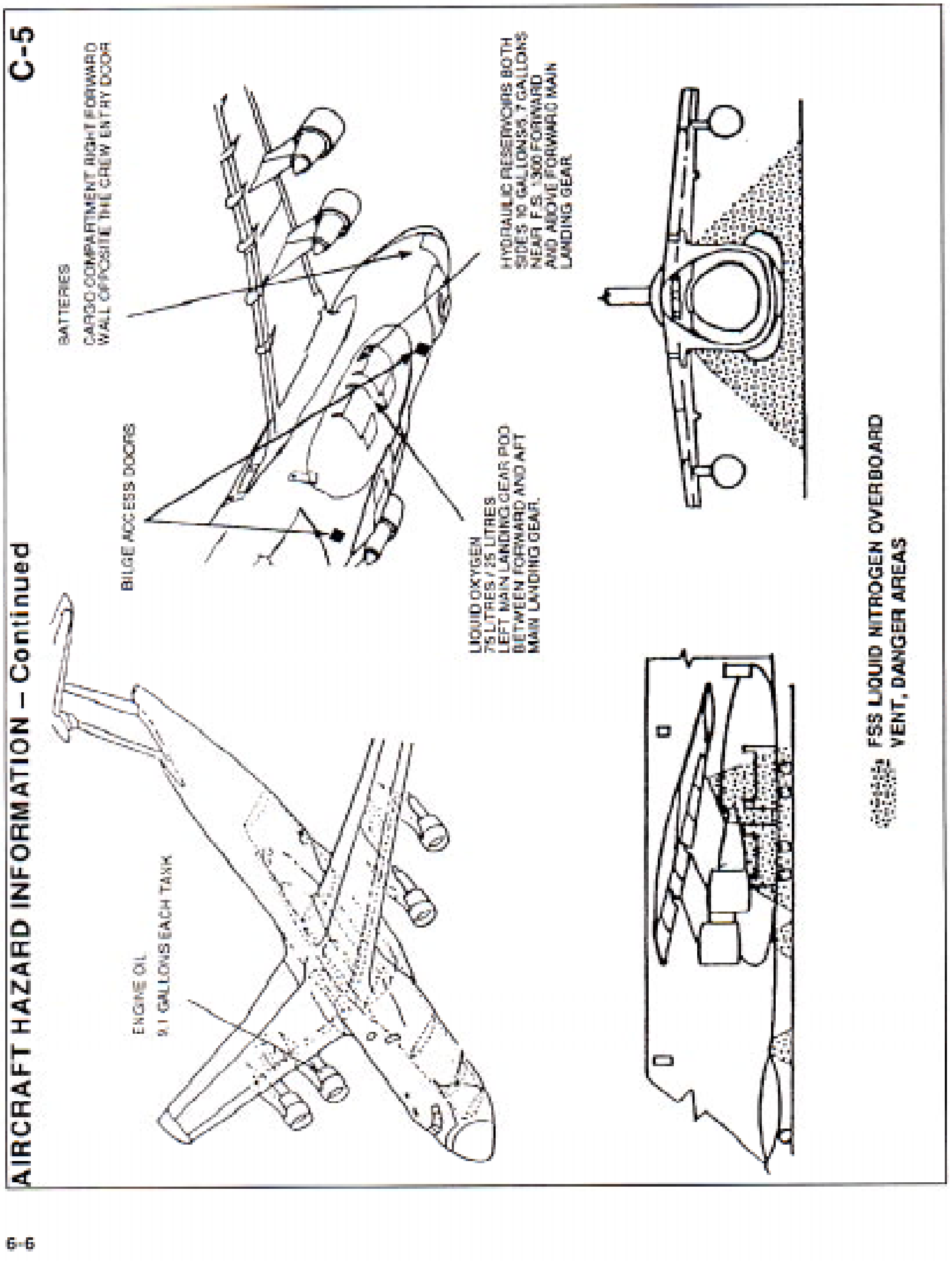
6-4

TO 00-105E-9



6-5

TO 00-105E-9



6-6

SPECIAL TOOLS/EQUIPMENT
35 ft Extension "A" Frame Ladder*
3/8 In. Drive Ratchet for Engine Cowling
Power Rescue Saw Portable Lights
SPAAT

AUDIOVISUAL
= 608564DF

TOTAL FUEL:
51,000 GALLONS

WARNING

Do not attempt to fight fire through APU and ATM compartment push-in doors during APU operation.

AIRCRFT ENTRY ALL MODELS

NOTE:

Crew entry door will usually have a mechanical lock installed on the inside and entry will not be possible. Use 7LT or 7RT.

1. NORMAL ENTRY

a. Open crew entrance door control access cover.

WARNING

Ensure no personnel are standing under door.

b. Pull the latch release handle (gray) down to pressurize the door system.

c. Push crew door operate handle (black) up.

NOTE:

If the hydraulic system accumulator is depleted, the door can be extended by using the hydraulic hand pump located behind the crew entrance door controls access cover.

d. Open aft personnel doors, No. 7LT and 7RT by pulling handles out, rotating clockwise and push in top of door lifting upward, to full up and locked position.

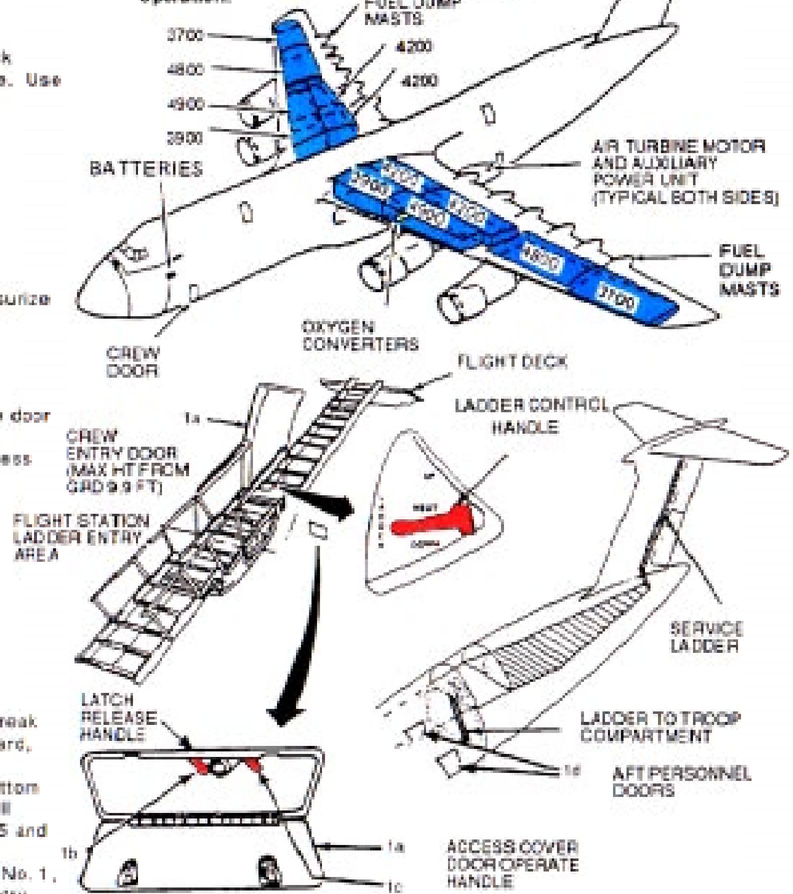
NOTE:

Escape slides must be deployed from inside.

2. EMERGENCY ENTRY

NOTE:

- All escape doors and hatches; if jamming occurs, break guide on top left corner of doors, doors will fall inward, then remove prior to deploying slide.
- *Bad ladder should be marked at 10th rung from bottom to indicate middle fly ladder catch location. This will extend proper amount of ladder to enter doors No. 5 and 6.
- Due to fuselage curvature and wing fillets, hatches No. 1, 2, 3 LT, and 3 RT should not be used as primary entry points with a ladder.



C-5

AIRCRAFT ENTRY – Continued

C-5

NOTE:

Manual oxygen shut-off valve should be shut off during interior fire fighting operations or any time the possibility of an oxygen-enriched fire occurs. The valve is normally safety-wired open, so a pair of wire cutters may be required to shutoff the valve. The valve is located behind a small compartment door which may be covered by aircraft insulation. Approximate location of the valve:

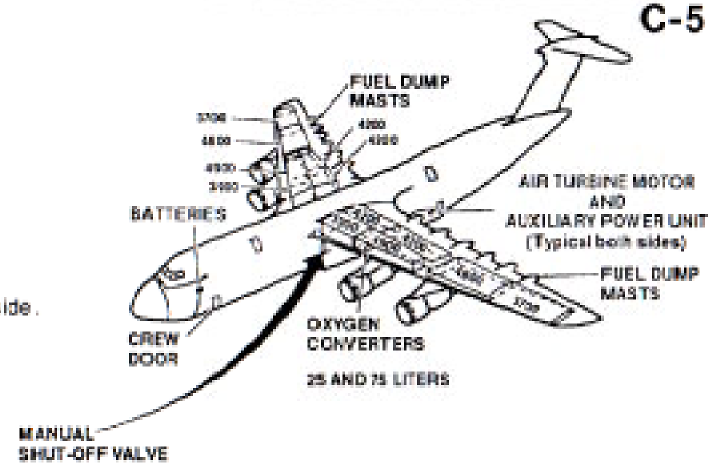
a) Midway through cargo compartment, aircraft's left side.

b) Near station #1460

c) 79 ft. from normal crew entry door.

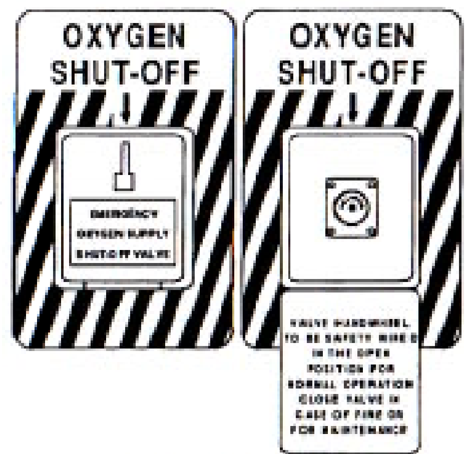
d) 32 ft. from door 7L.

e) 3 ft. above cargo deck.



NOTE:

Hydaulic system operating pressure is 3000 PSI. Four systems are located in the walls of the cargo compartment: (1) 10 gallons on the left wall near fuselage station 1300, just forward and above the left forward main landing gear. (2) 5.7 gallons on the left wall just forward of the #1 system. (3) 5.7 gallons on the right wall opposite #2 system. (4) 10 gallons on the right wall aft of #3 and opposite #1 system.



B
MANUAL SHUT-OFF VALVE

WARNING

When landing gears are in the extended position, hydraulic lines to doors and locks are pressurized. This creates a possible hazard should the lines be ruptured. A ruptured condition can be identified by a high pressure mist.

AIRCRAFT ENTRY – Continued

a. Open escape door No. 5 by pulling handle, rotating clockwise and push in at top and lift upward, to full up and locked position.

b. Open escape hatch No. 1 and hatch No. 2 by pulling handles and removing hatches. Hatch No. 1 is hinged. Hatch No. 2 falls free.

c. Open aft personnel doors No. 7LT and 7RT by pulling handles out, rotate clockwise and push in top of door and lift upward to full up and locked position.

d. Open escape hatches No. 3LT and 3RT (troop compartment) by depressing lock on panel and pulling handle upward, push in door and pull upward at bottom of door. Hatches will fall inward.

e. Open escape door No. 6 3LT and 3RT (troop compartment) service door (left side only) by pulling handle out, rotate clockwise and push door in and lift upward to full up and locked position.

f. Open escape door No. 4 (right side only) by pulling handle out and down. Hatch falls inward when unlatched.

NOTE:

Access cannot be gained from flight deck to the troop compartment in the upper deck and vice versa.

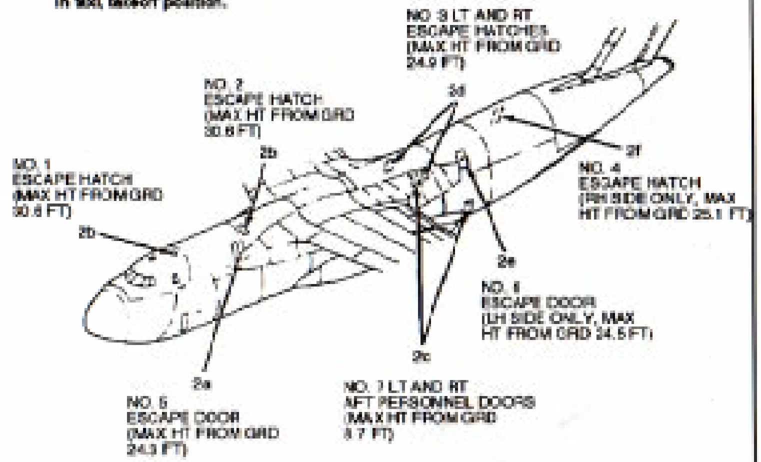
ESCAPE SLIDE DEPLOYMENT

1. Release the quick disconnect buckle.
2. Using the assist handle(s), lift case straight up and rest bottom of case on sill of hatch.
3. Push case overboard by applying force to the upper edge of the case. The case should split and fall. The escape slide should unfold and automatically inflate as it falls to the ground.
4. If the case does not split or the slide does not inflate, grasp both cables attached to the girt bar, slide your hand down the cables as far as possible and then sharply pull the cables. The retaining straps should part, case split, and the slide inflate. If the slide does not inflate pull the red webbing handle marked "Pull to Inflate."

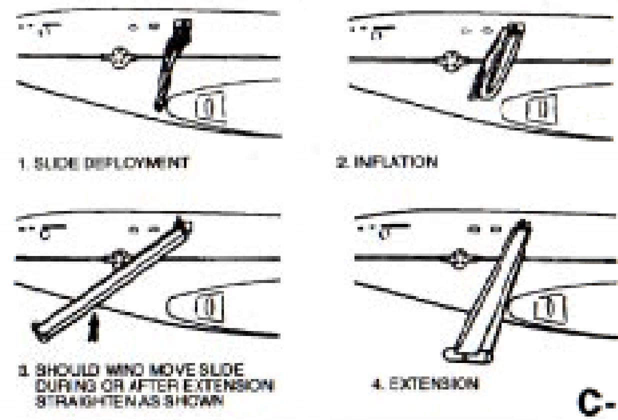
NOTE:

Five (5) slides are installed, escape doors No. 5 and 6; and escape hatches No. 3LT and RT and 4.

NOTE:
Heights are with landing gear in taxi, takeoff position.



ESCAPE SLIDE DEPLOYMENT



C-5

TO 00-105E-9

AIRCRAFT ENTRY – Continued

C-5

NOTE:
Escape slides are installed at doors 7R&L when pallet seats are on aircraft.

3. CUT-IN

a. Left and right side of relief crew compartment.

b. Two (2) each side of troop compartment aft of service door No. 6 and escape hatch No. 4.

c. Left and right side of forward cargo compartment forward of wheel pods.

NOTE:
Access cannot be gained from flight deck to the troop compartment in the upper deck.

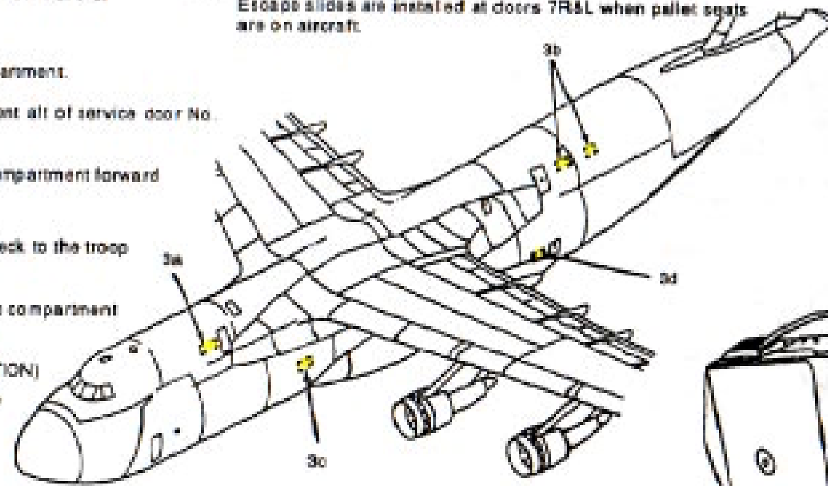
d. Left and right side forward of aft cargo compartment personnel doors.

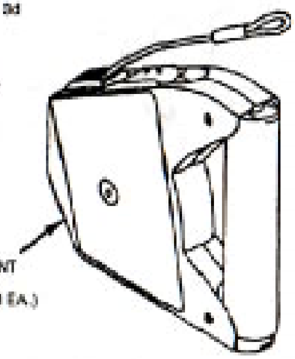
4. CREW ENTRY DOOR (INSIDE OPERATION)

a. Remove the Mechanical Lock from the door.

b. Pull down on the crew entrance door emergency egress handle, and push out on crew door.

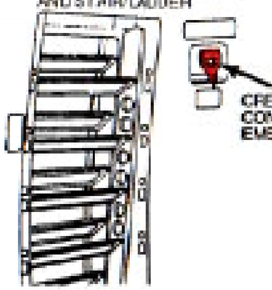
c. Push down and hold on door control if needed, then push door open.

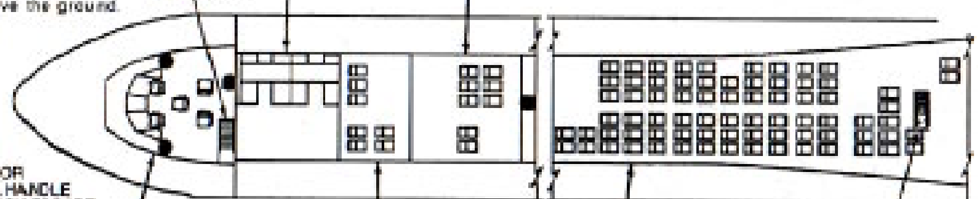




WARNING

The crew entrance ladder may not fully extend and may be as much as 5 feet above the ground.





6-10

ENGINE/APU SHUTDOWN AND AIRCREW EXTRACTION

1. ENGINE/APU SHUTDOWN

a. Pull fire emergency control T-handles, located top center portion of the pilot instrument panel.

NOTE:
Battery switch is not required to be turned off.

b. Pull fire emergency control T-handles located on upper left corner of flight engineer control panel, to shut off both auxiliary power units.

NOTE:
Fire Emergency Control T-handles for APUs are located inside crew entry door at the Fwd Load Masters Panel.

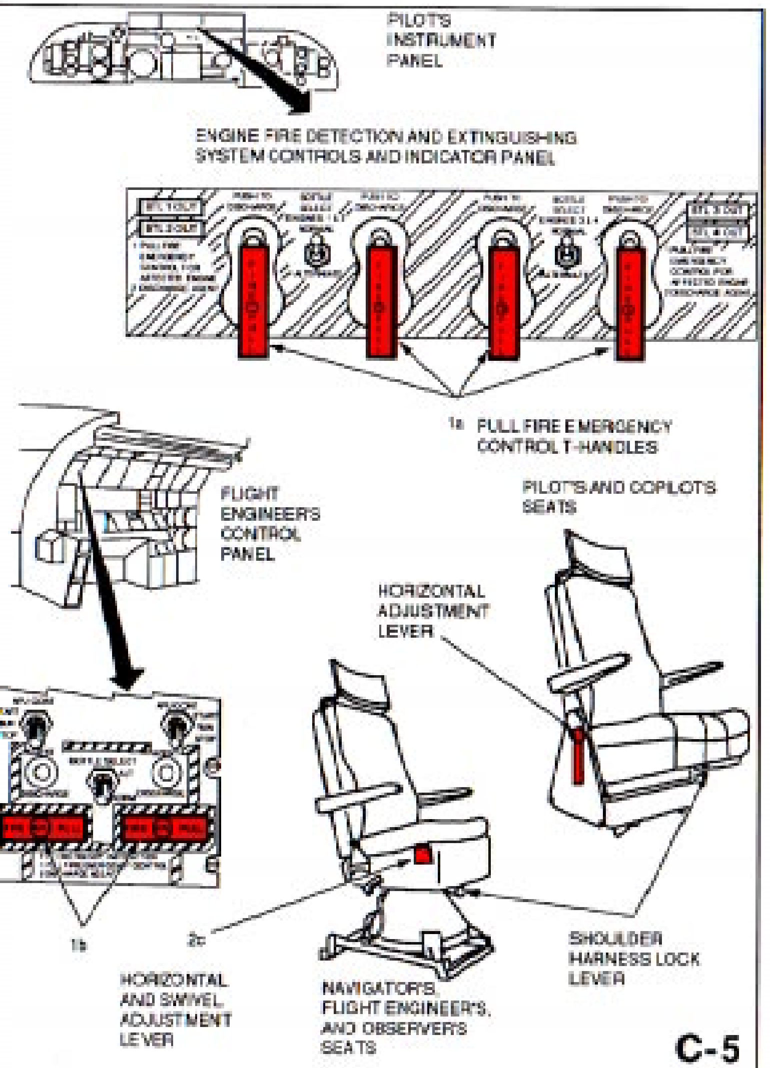
2. AIRCREW EXTRACTION CREW COMPARTMENT C-5A AF 66-8303 THROUGH 70-0467

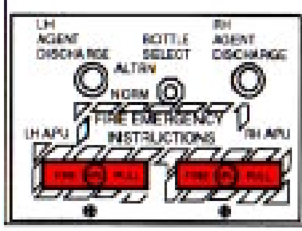
a. Seats for NAV, ENGR, and OB, pivot and position aft. For pilot and copilot seats, push outboard.

b. Release lap belts and remove shoulder harness restraint straps.

c. Push knob forward to move seat horizontally in track. Rotate knob clockwise to rotate seat 90 degrees left or right.

NOTE:
Troop deck seats are equipped with lap belts only.





APU FIRE EMERGENCY CONTROL T-HANDLES FWD LOADMASTERS PANEL

C-5

6-11

AIRCREW EXTRACTION – Continued

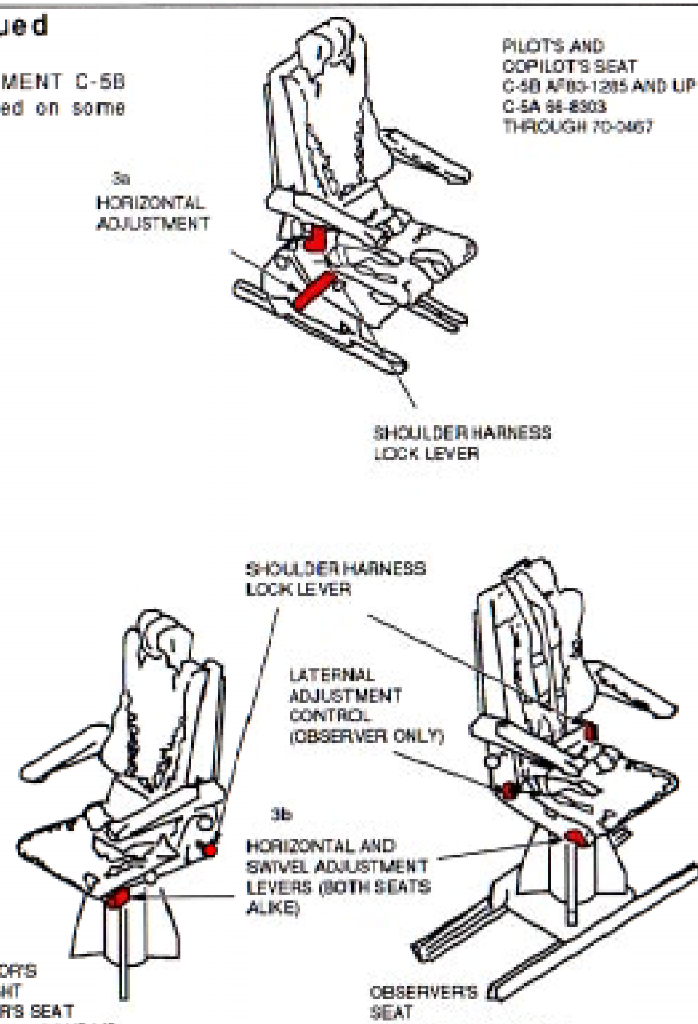
C-5

3. AIRCREW EXTRACTION CREW COMPARTMENT C-5B AF 83-1285 AND UP. (May also be installed on some C-5A aircraft.)

a. Move pilot's and copilot's seats full aft and outboard. Pull aft on horizontal adjustment lever to move the seat forward and aft and push lever toward the seat for lateral movement.

b. Rotate navigator's, flight engineer's, and observer's seat 90 degrees left or right. Push down on the horizontal adjustment lever and the swivel release lever on the seats to move them horizontally and to swivel.

c. Release lap belts and remove shoulder harnesses.



FIRE SUPPRESSION SYSTEM (FSS)

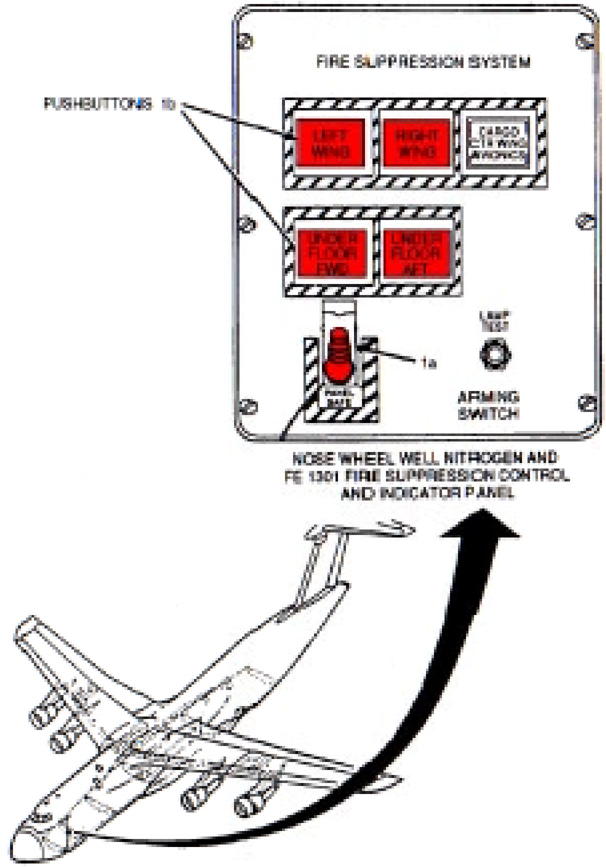
WARNING

Do not remain in a closed space with nitrogen without an oxygen mask. Nitrogen is a harmless gas, but when it occupies a closed space to the exclusion of breathable air it can result in suffocation of personnel.

NOTE:

- All C-5 aircraft have a fire detection system; FE1301 FSS, and nitrogen FSS. FE1301 FSS on C-5A aircraft is a one-shot discharge into the affected area. All C-5B aircraft have a fire detection system and nitrogen FSS. C-5B **DOES NOT** have FE1301 FSS. For the C-5B aircraft, the buttons on the FSS control panels for occupied areas are indicator lights only, for the detection system. They will not discharge FE1301. C-5A and C-5B nitrogen FSS can be discharged more than once (2 of 3 times) into the same affected area if needed. For ALL C-5A aircraft, the FE1301 FSS can be armed from the nose wheelwell or the flight engineer's control panel. The FE1301 system can be discharged only from the flight engineer's control panel. There is a FE1301 indicator panel in the cargo bay near door 7 left.

- Nose wheelwell nitrogen control panel provides fire suppression capabilities for the left wing; right wing; under floor fwd; under floor compartments. Control panel will be inaccessible if aircraft is encountered in a gear up crash configuration or forward kneel position, and other fire suppression methods must be employed. The FSS panel operates off the battery.



C-5

FIRE SUPPRESSION SYSTEM – Continued

C-5

2. NITROGEN FIRE SUPPRESSION CONTROL AND INDICATOR PANEL

NOTE:

Nitrogen can be semi-depleted on long flights. Nitrogen gas fills the empty space of used fuel.

a. Place arming control switch, located on the FE1301 Fire Suppression Control and Indicator Panel on lower left section of flight engineer's overhead control panel to ARM position.

NOTE:

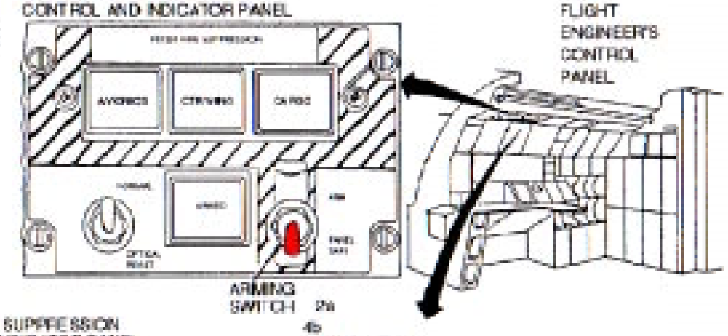
On C-5B 83-1285 and up, the fire suppression control panel is inscribed FIRE SUPPRESSION.

b. Depress discharge pushbuttons for affected area to discharge nitrogen fire suppression system.

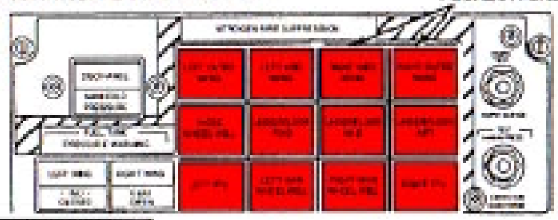
NOTE:

The twelve nitrogen discharge pushbuttons located on the nitrogen fire suppression control and indicator panel at the flight engineer's station discharge nitrogen into their associated fire zones, as indicated in figure 1. Aircraft power is required to operate this panel.

FE1301 FIRE SUPPRESSION CONTROL AND INDICATOR PANEL



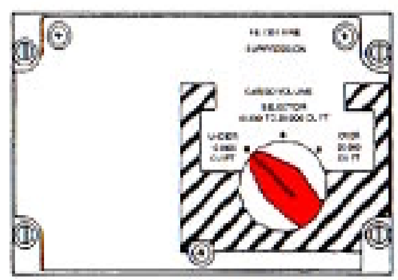
NITROGEN FIRE SUPPRESSION CONTROL AND INDICATOR PANEL



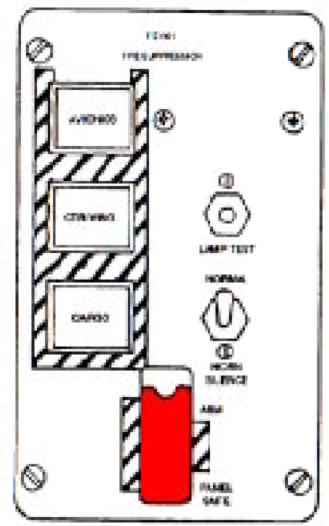
NITROGEN FIRE SUPPRESSION ZONES AND CONTROLS
(ON AIRPLANES MODIFIED BY TO [illegible])

ZONE	SPACES INCLUDED IN ZONE	FLIGHT ENGINEER'S PANEL DISCHARGE PUSHBUTTON	NOSE WHEEL WELL PANEL DISCHARGE PUSHBUTTON
1	LEFT WING DRY BAY, LEFT OUTBOARD LEADING EDGE, LEFT OUTBOARD PYLON LEADING EDGE	LEFT OUTBD WING	LEFT WING
2	LEFT WING ROOT DRY BAY, LEFT INBOARD LEADING EDGE, LEFT INBOARD PYLON LEADING EDGE	LEFT INBD WING	
3	RIGHT WING ROOT DRY BAY, RIGHT INBOARD LEADING EDGE, RIGHT INBOARD PYLON LEADING EDGE	RIGHT INBD WING	RIGHT WING
4	RIGHT WING DRY BAY, RIGHT OUTBOARD LEADING EDGE, RIGHT OUTBOARD PYLON LEADING EDGE	RIGHT OUTBD WING	
5	NOSE WHEEL WELL	NOSE WHEEL WELL	
6	CARGO UNDERFLOOR, FORWARD	UNDERFLOOR FWD	UNDERFLOOR FWD
7	CARGO UNDERFLOOR MID	UNDERFLOOR MID	
8	LEFT MAIN WHEEL WELL	LEFT MAIN WHEEL WELL	
9	RIGHT MAIN WHEEL WELL	RIGHT MAIN WHEEL WELL	
10	CARGO UNDERFLOOR, AFT	UNDERFLOOR AFT	UNDERFLOOR AFT
11	LEFT PTU COMPARTMENT	LEFT PTU	UNDERFLOOR FWD
12	RIGHT PTU COMPARTMENT	RIGHT PTU	

FIGURE 1



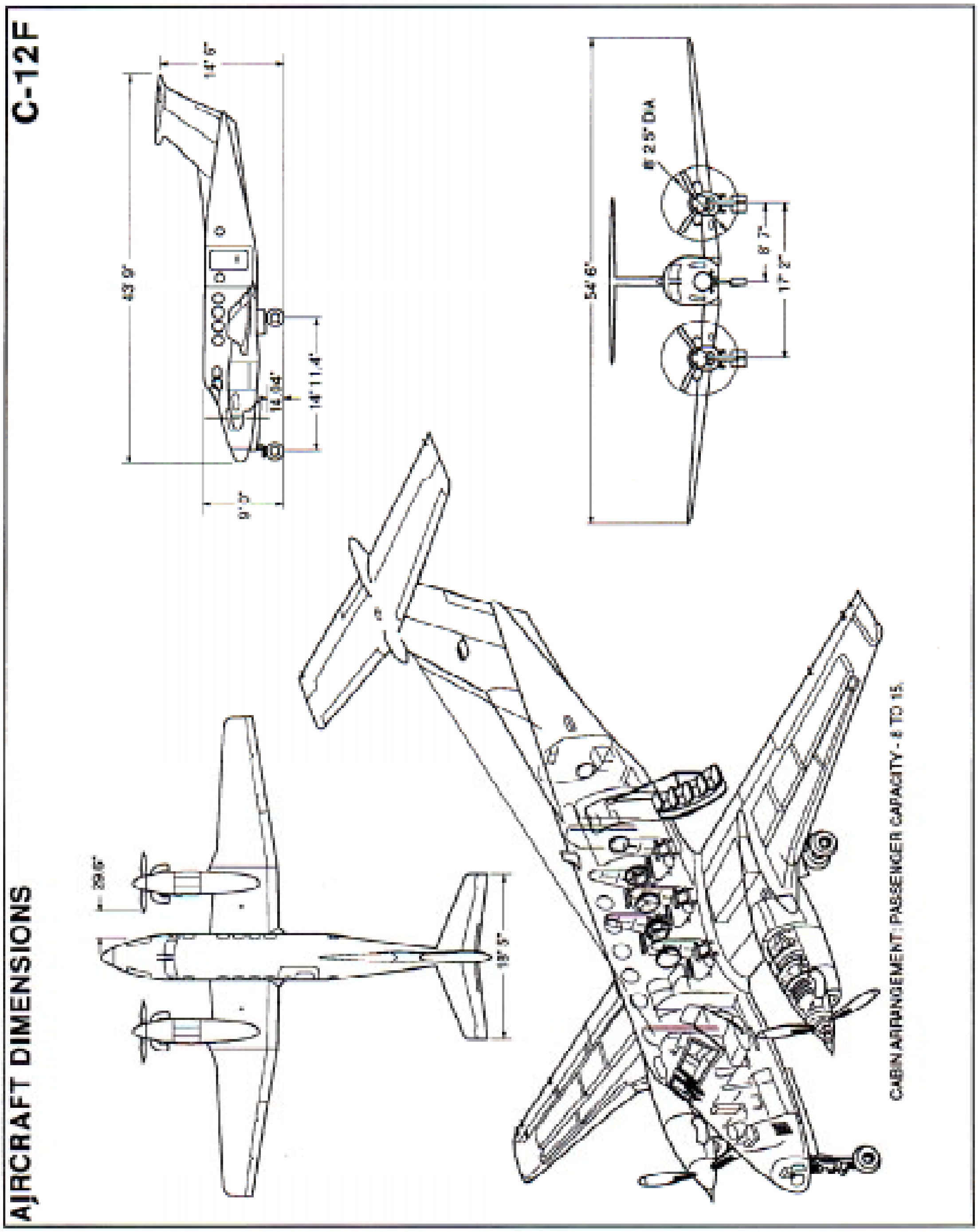
CARGO VOLUME SELECTOR PANEL



CARGO COMPARTMENT FE1301 FSS PANEL

C-12 Huron

TO 00-105E-9



6-24

SPECIAL TOOLS/EQUIPMENT
Power Rescue Saw

AIRCRAFT ENTRY
ALL MODELS

1. NORMAL ENTRY

a. Depress button adjacent to door handle in center of passenger door.

b. Rotate handle, located in center of passenger door left side of aircraft, and swing door down.

NOTE:
- Difficulty in opening door with engine(s) running may be caused by inflated door seal.
- On D & F models the cargo door can only be opened from inside.

2. EMERGENCY ENTRY

a. Pull out handle on Emergency Exit Hatch, located on right side of fuselage.

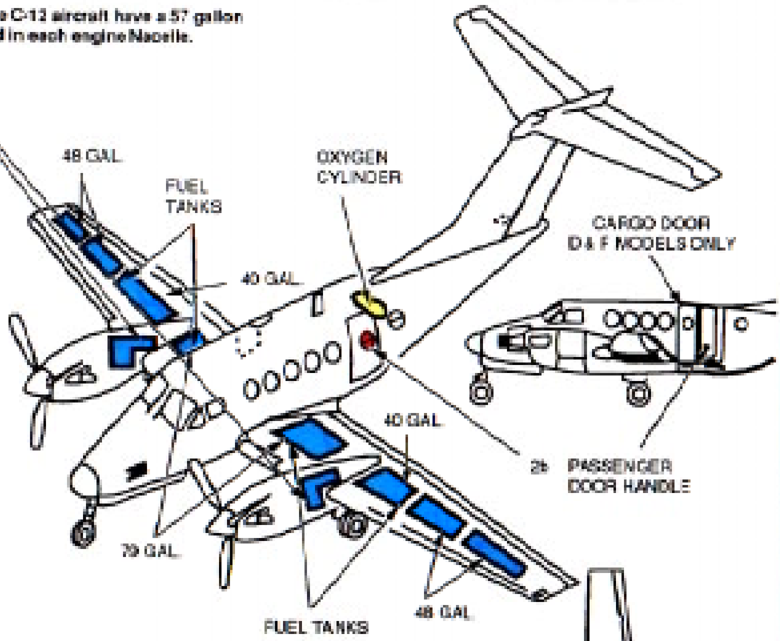
b. Push in on hatch and remove from fuselage.

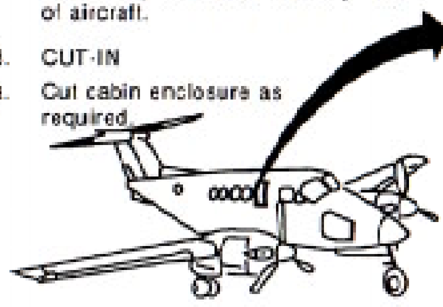
NOTE:
Hatch may be locked with key from inside of aircraft.

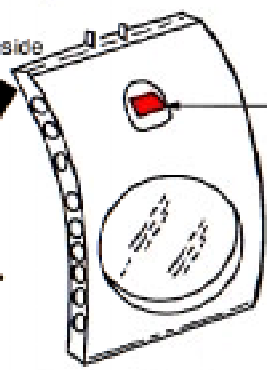
3. CUT-IN

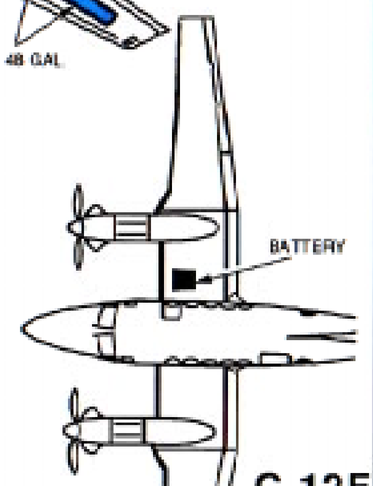
a. Cut cabin enclosure as required.

NOTE:
All Models of the C-12 aircraft have a 57 gallon fuel tank located in each engine Nacelle.









C-12F

ENGINE SHUTDOWN AND AIRCREW EXTRACTION

C-12F

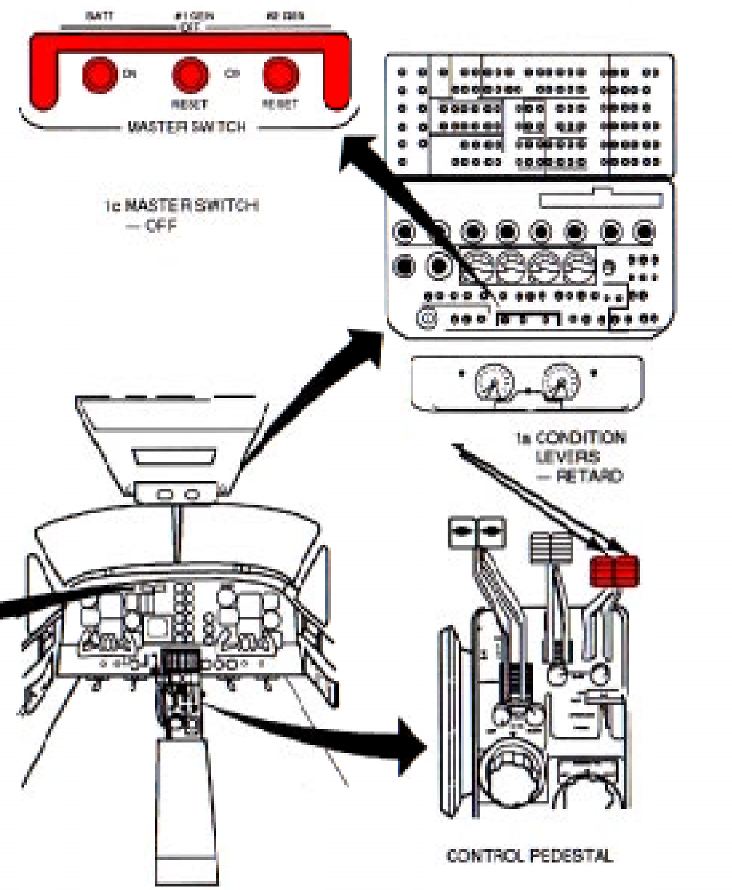
1. ENGINE SHUTDOWN (All Models Except C-12F)

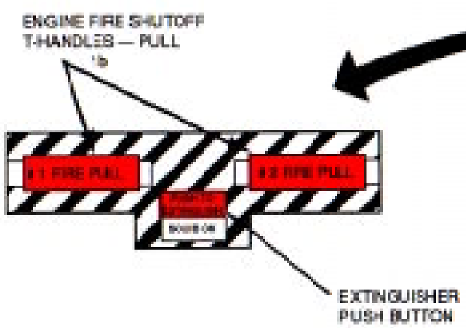
a. Retard condition levers, located on right side of pilot's control pedestal, to FUEL CUT OFF POSITION.

b. Pull engine fire shutoff T-Handles, located on upper portion of pilot's instrument panel.

NOTE:
If Fire T-Handles are illuminated, actuate Fire Extinguisher Push Button, located between Fire T-Handles.

c. Place master switch, located on pilot's overhead control panel, to OFF position.





ENGINE SHUTDOWN AND AIRCREW EXTRACTION - Continued

2. ENGINE SHUTDOWN C-12F

a. Retard propeller levers and condition levers, located on center control pedestal, to CUT-OFF position.

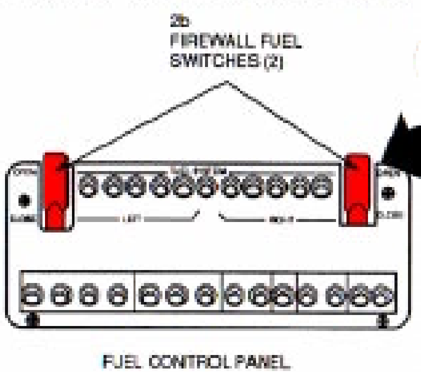
b. Place firewall fuel switches (2), located on the fuel control panel, left side console below boost pump switches, to OFF position.

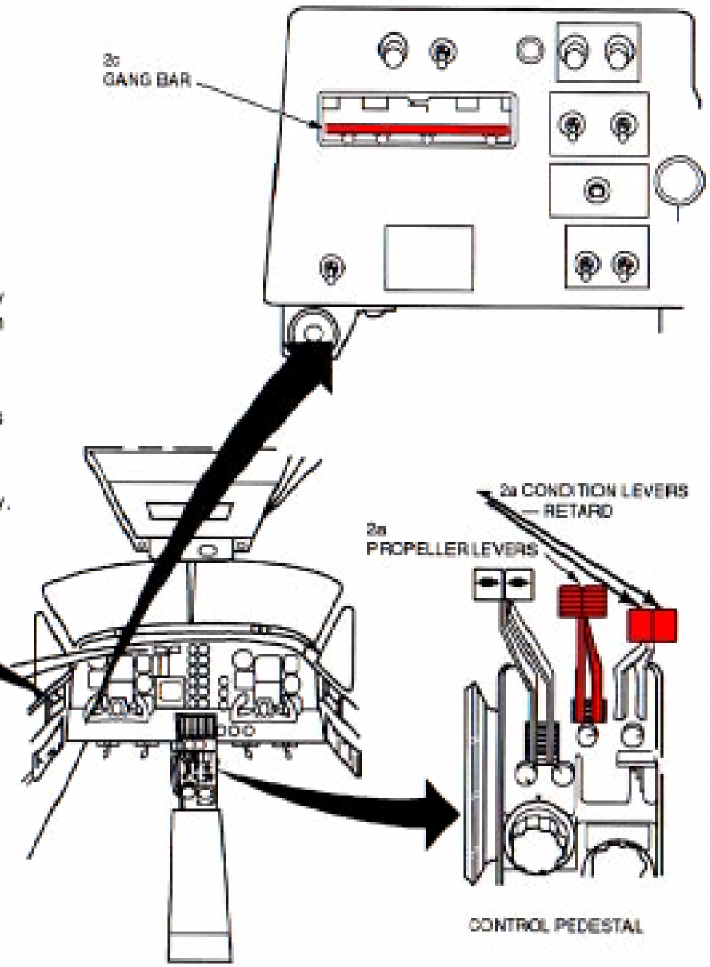
c. Position gang bar for master switch and battery switch, located lower left instrument panel, to down position.

3. AIRCREW EXTRACTION

a. Unlatch lap belts and remove shoulder harness from crewmember(s).

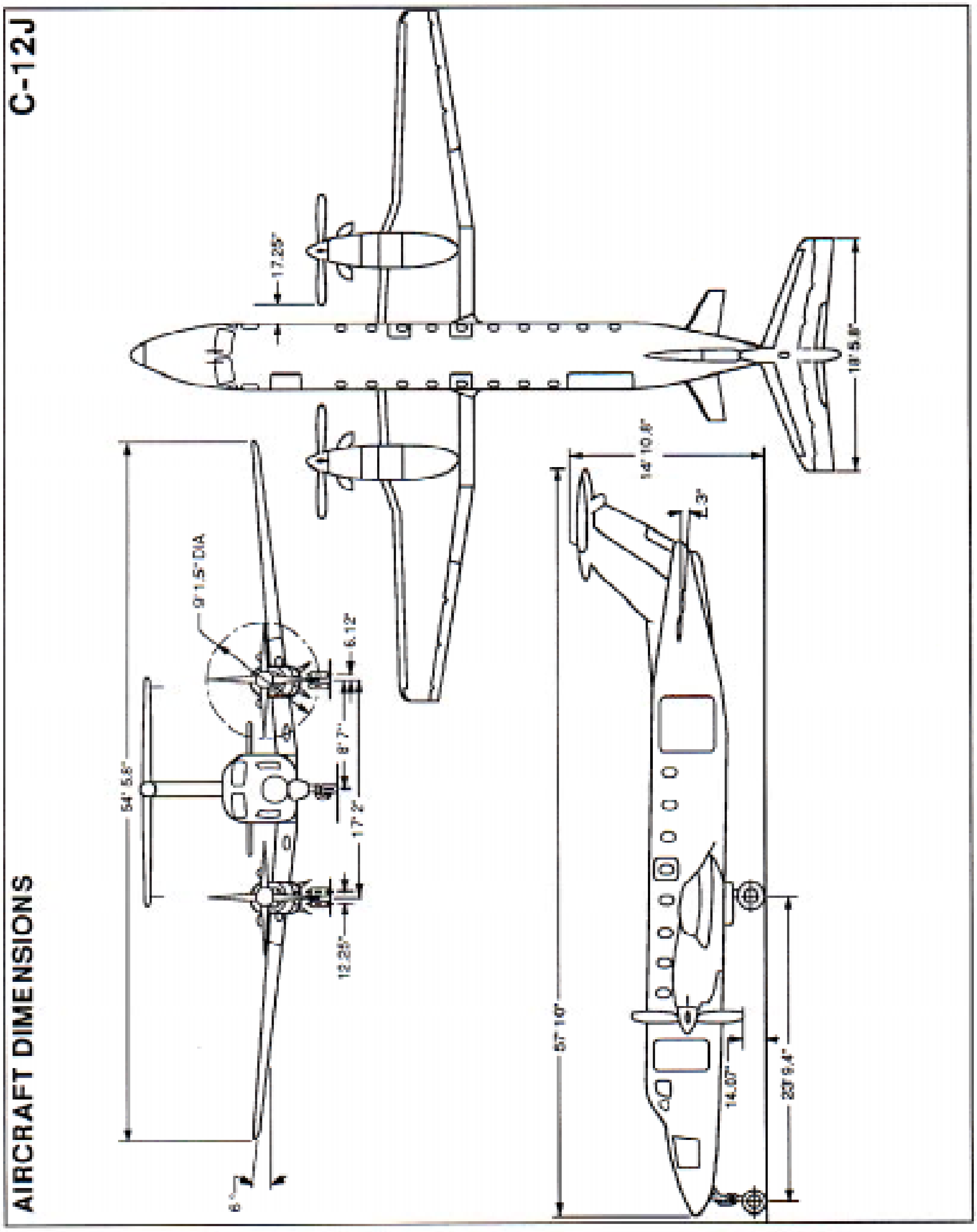
NOTE:
Passenger seats are equipped with lap belts only.





C-12F

TO 00-105E-9



6-28

SPECIAL TOOLS/EQUIPMENT
Power Rescue Saw

AIRCRAFT ENTRY

1. NORMAL ENTRY

a. Depress button adjacent to door handle in center of passenger door or cargo door.

b. Rotate handle clockwise. Passenger door opens down. Cargo door opens up.

WARNING

Do not enter through crew door with left engine running. Beware of left engine exhaust/turbulence when entering the cargo door.

NOTE:
Difficulty in opening door with engine(s) running may be caused by inflated door seal.

2. EMERGENCY ENTRY

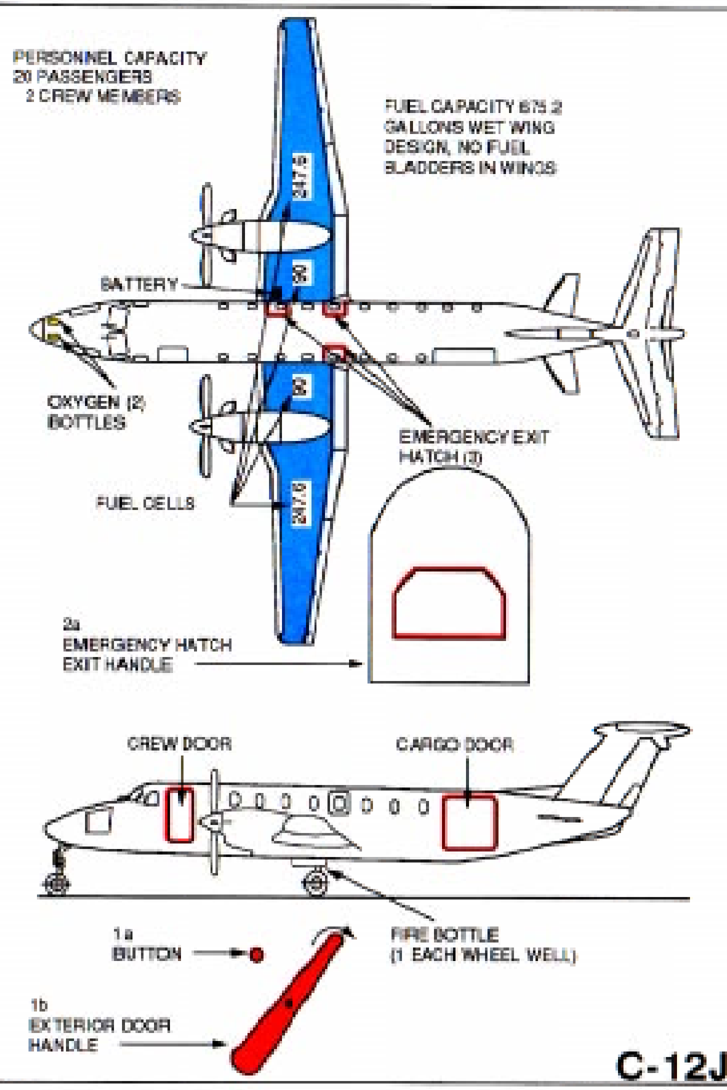
a. Pull out handle on Emergency Exit Hatch located over right wing (two places) and left wing (one place).

b. Push in on hatch and remove from fuselage. Door locks can be over ridden from inside the aircraft when locked.

NOTE:
Hatch may be locked with key from inside of aircraft.

3. CUT-IN

a. Cut cabin enclosure as required.



C-12J

ENGINE SHUTDOWN AND AIRCREW EXTRACTION

C-12J

1. ENGINE SHUTDOWN

a. Retard Propeller Levers and Condition Levers, located on right side of pilot's control pedestal, to CUT OFF position.

b. Pull 5 AMP Firewall Valve circuit breakers (right and left), located on the fuel control panel, left side console, to OFF position. (Go to step e, if no engine fire.)

c. IN CASE OF ENGINE FIRE: Push Fire Bottle actuating switches, located above right and left fire T-handles.

d. Pull Engine Fire Shutoff T-handles, located on upper portion of pilot's instrument panel. Agent is CB.

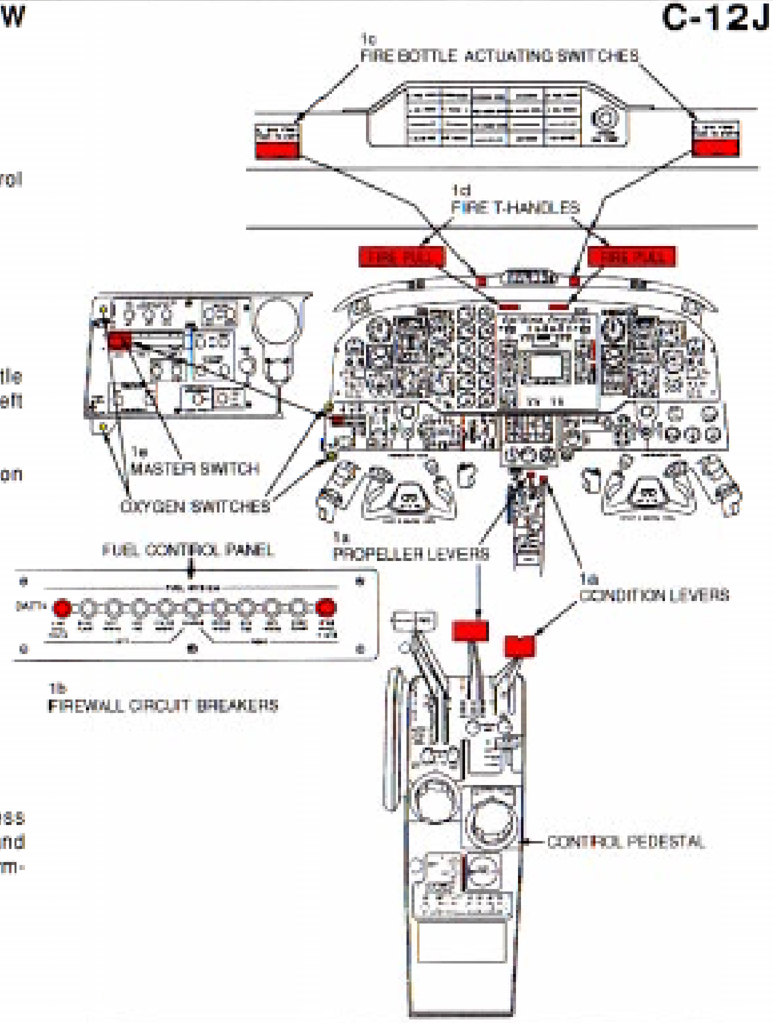
e. Place Master switch, located on pilot's lower left instrument panel, to OFF position.

NOTE:
Oxygen shutoff push/pull switches (2), are located on left side of instrument panel. 02 capacity is 38.3 liters. No LOX is used.

3. AIRCREW EXTRACTION

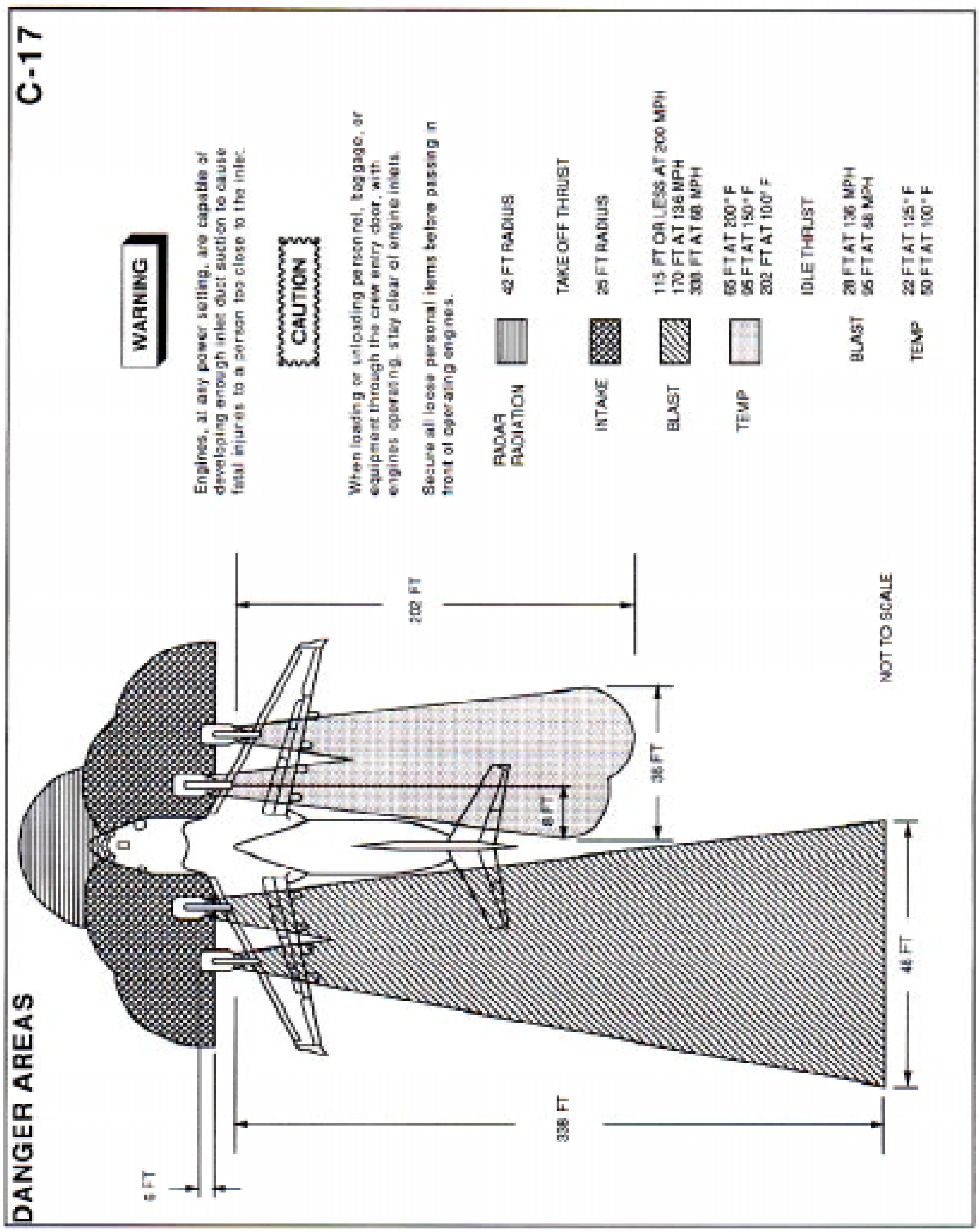
a. Unlatch lap belts and remove shoulder harness from crewmembers. Crew seats have up and down and forward and back movement only. Armrests lift up.

b. Unlatch lap belts from passengers.



C-17 Globemaster III

TO 00-105E-9



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FLOTATION EQUIPMENT DEPLOYMENT SYSTEM (FEDS)

NOTE:

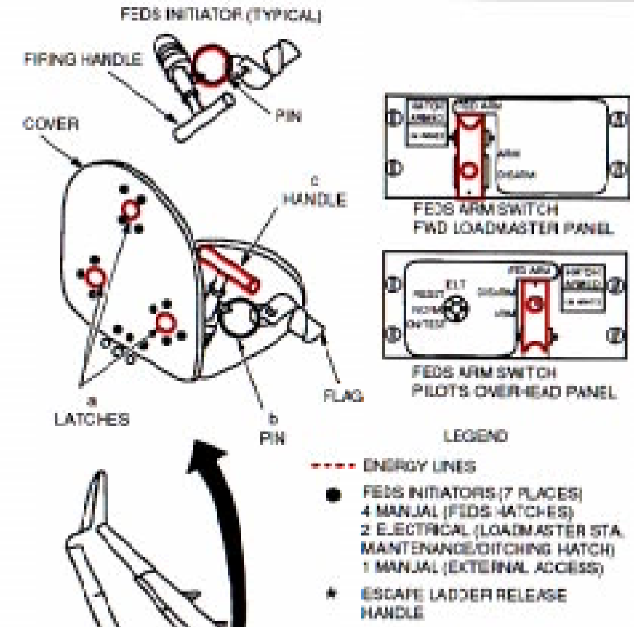
- FEDS is a ditching egress system incorporating four pyrotechnically produced hatch openings. Containerized life rafts are automatically ejected from three of the openings (forward: left and right; aft - right). Each raft automatically inflates after ejection and remains attached to the aircraft with a tether.
- FEDS hatches are not to be used for external entry, and are not emergency cut-in areas.
- The external FEDS initiator handle is located on the upper fuselage, left side, forward of the wing root. To activate FEDS with the external initiator handle:
- The external FEDS initiator handle is not installed on T-1, 87-0025.

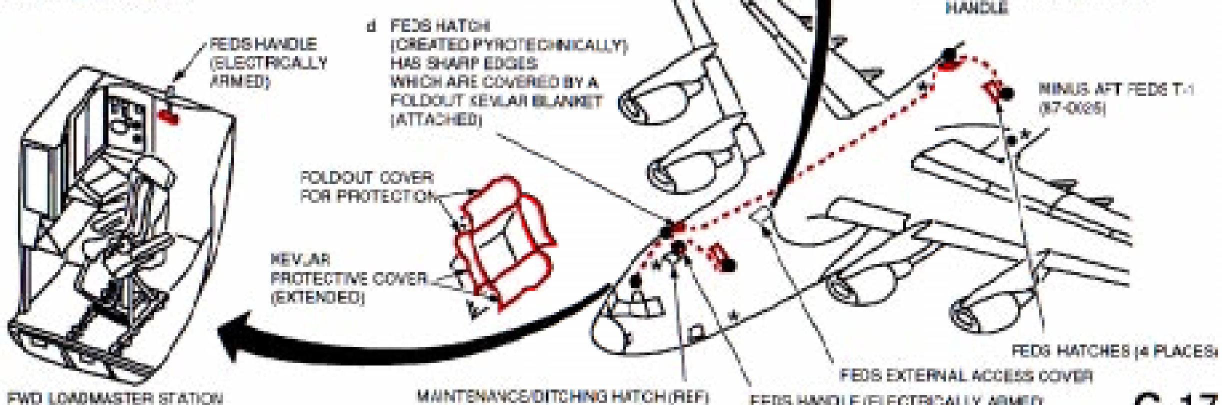
a. Release access cover quick release latches (3 places) and open cover.

b. Pull ring to remove initiator safety pin.

c. Turn handle 90 degrees and pull.

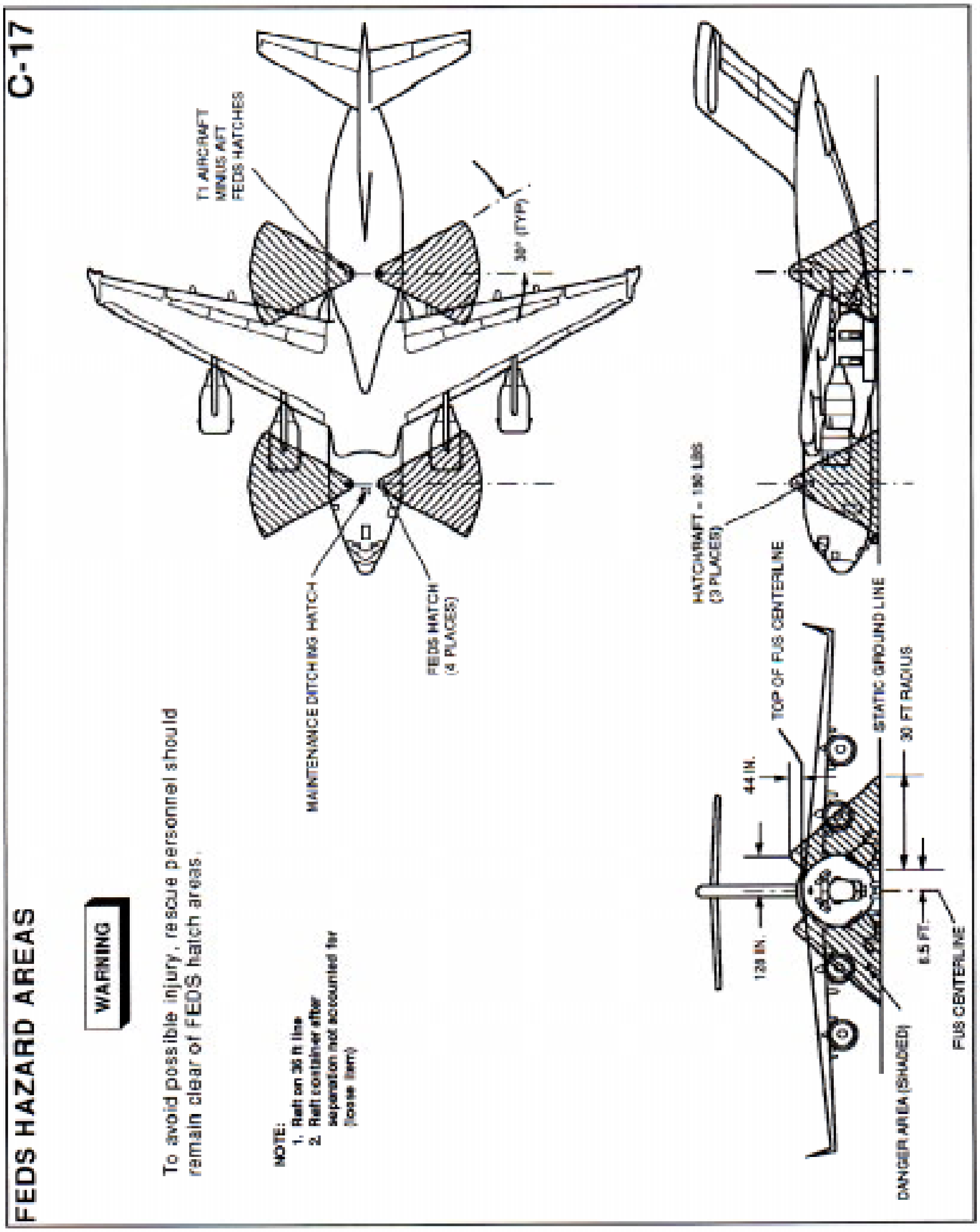
d. Place attached kevlar covers over cut edges for personnel evacuation.





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TO 00-105E-9



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AIRCRAFT HYDRAULIC SYSTEM

NOTE:

Hydraulic power supply consists of four independent, continuously operating 4000 psi pressurized systems. Four individual hydraulic systems network the aircraft as indicated.

a. Each or the four system reservoirs have specific hydraulic fluid quantities:

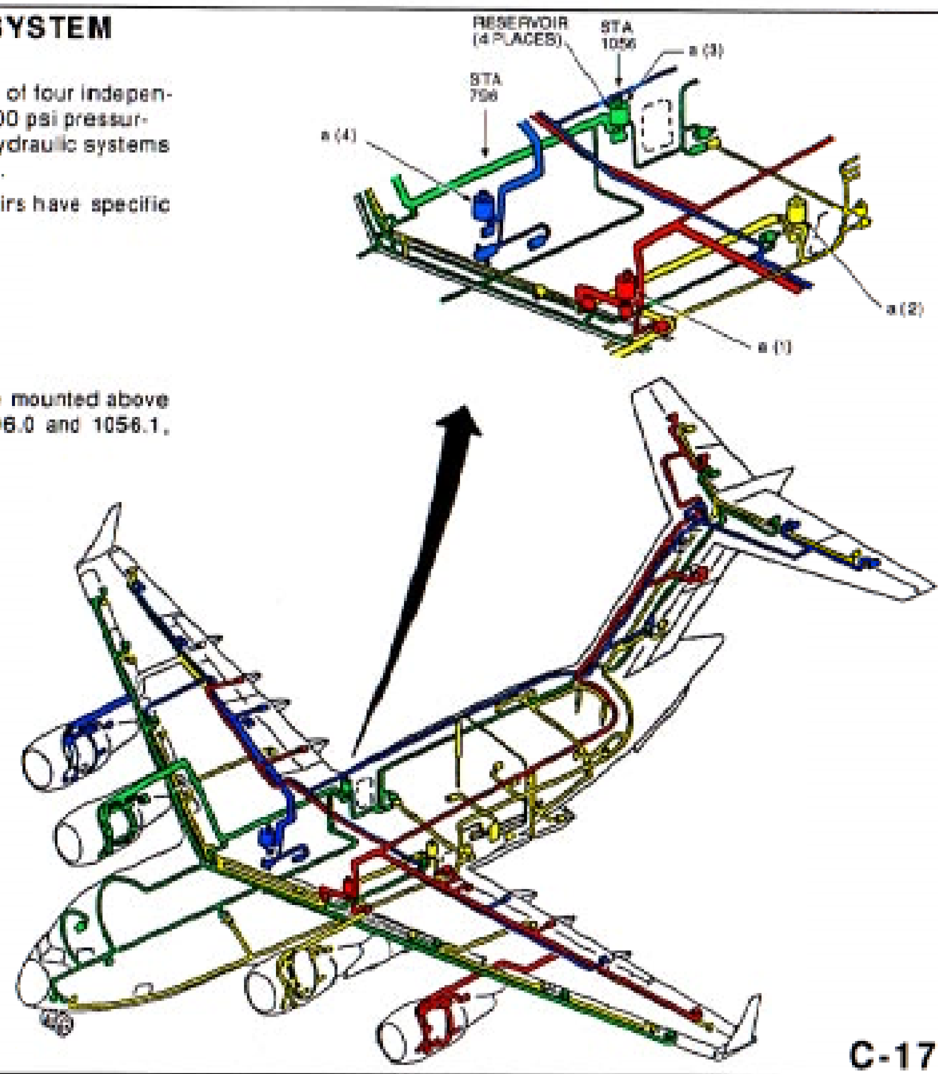
(1) System 1 - 11.1 gallons.

(2) System 2 - 18.5 gallons.

(3) System 3 - 13.5 gallons.

(4) System 4 - 11.1 gallons.

b. Four main system reservoirs are mounted above aircraft centerline at stations 796.0 and 1056.1, two reservoirs on each side.



LEGEND

- HYDRAULIC SYSTEM NO. 1
- HYDRAULIC SYSTEM NO. 2
- HYDRAULIC SYSTEM NO. 3
- HYDRAULIC SYSTEM NO. 4

AIRCRAFT OXYGEN SYSTEM LOCATIONS

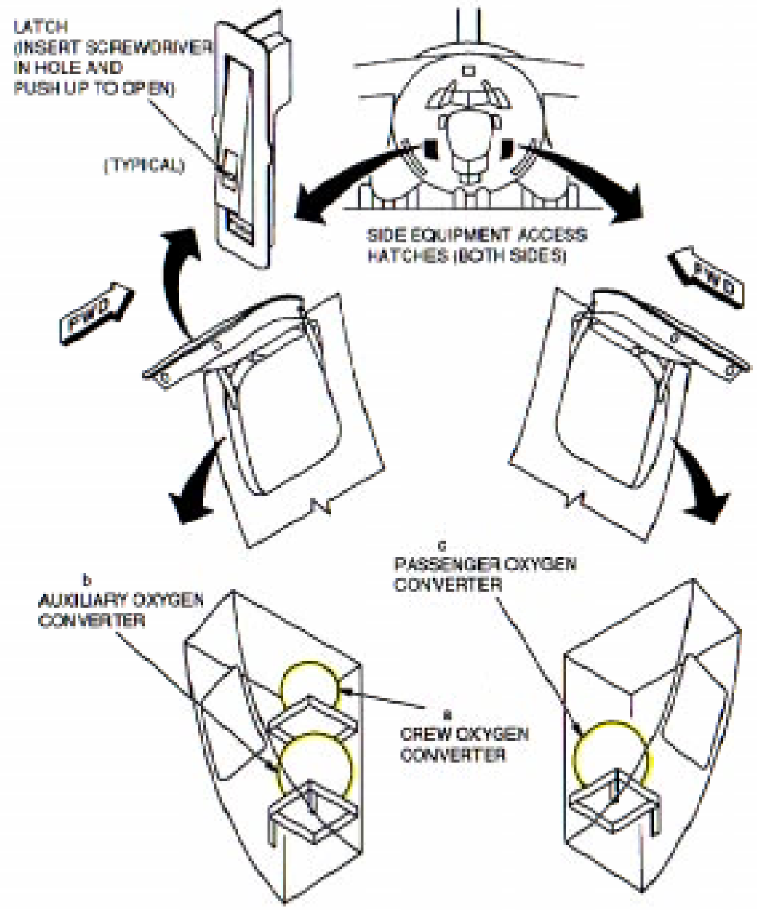
C-17

NOTE:
The aircraft oxygen system consists of three separate oxygen converters which are located approximately eight feet above ground level.

a. The crew oxygen system consists of one 25 liter converter located in the right nose compartment. (Minus 87-0025, 88-0265, and 88-0266.)

b. The auxiliary converter (75 liters) is also located in the right nose compartment directly below the crew converter.

c. The passenger converter (75 liters) is located in the left nose compartment opposite the crew converter. Access is similar to crew and the auxiliary converter inside a protective shroud. (Minus 87-0025, 88-0265, and 88-0266.)

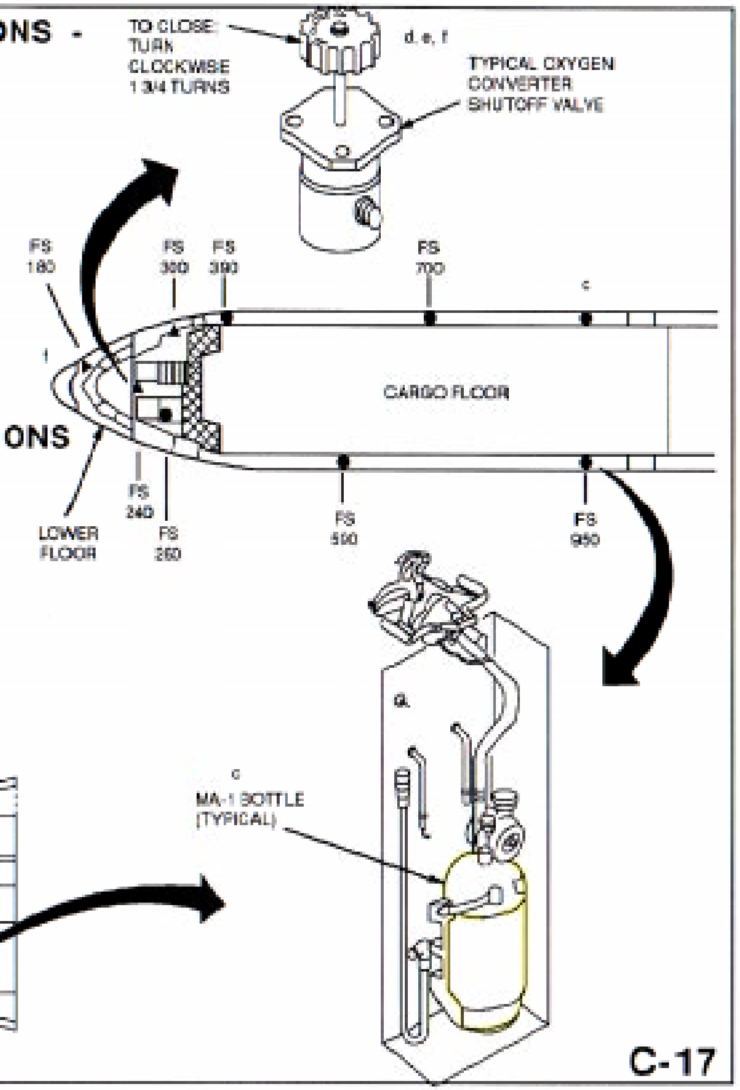


AIRCRAFT OXYGEN SYSTEM LOCATIONS - (Continued)

d. The auxiliary oxygen system manual shutoff valve in located at the forward loadmaster station, FS 300.

e. The passenger converter manual shutoff valve is located forward of the galley at FS 400. (Minus 87-0025, 88-0265, and 88-0266.)

f. The crew oxygen converter manual shutoff valve is located on the copilot's console at FS 180. (Minus 87-0025, 88-0265, and 88-0266.)



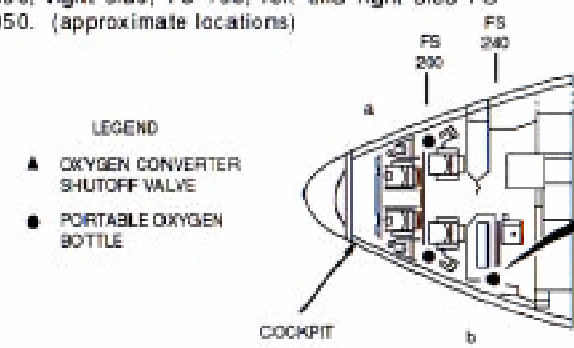
AIRCRAFT PORTABLE OXYGEN LOCATIONS

Nine portable oxygen bottle units are installed as follows:

a. Two in the cockpit, left and right side FS 200.

b. One in the crew rest area, left side, FS 240.

c. One in the lavatory, FS 260. Five in the cargo compartment, right side, FS 390, left side, FS 590, right side, FS 700, left and right side FS 950. (approximate locations)



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ONBOARD INERT GAS GENERATING SYSTEM (OBIGGS) (Minus T-1, 87-0025)

C-17

NOTE:

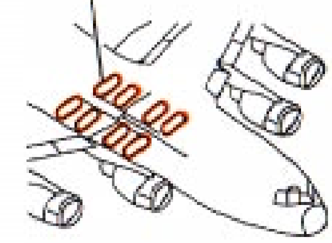
OBIGGS generates Nitrogen Enriched Air (NEA) for use in the fuel tanks. The NEA is used to keep fuel vapors in the fuel tank wing (ullage) areas inert (below the ignition point) during all phases of operation except refueling. The OBIGGS system functions automatically.

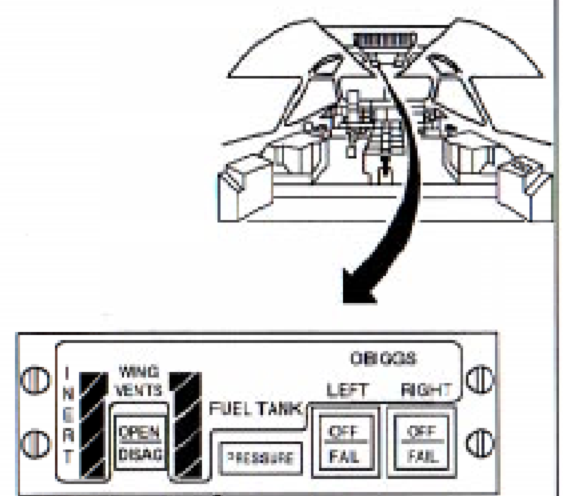
- The OBIGGS will not be installed initially, including the OBIGGS controller on T-1 (87-0025). The inert panel on the pilot overhead panel is operable to allow opening of the fuel vent valves if necessary. The two OBIGGS switches are installed but are inoperable on T-1 (87-0025).
- OBIGGS switch controls are located on the overhead panel within the flight compartment for flight activity. Ground operation of this system is controlled through a panel located on the maintenance monitor system located near the forward loadmaster station.

a. Two identical half systems consisting of two sets (4 cylinders each) are located under the cargo floor at station 708.5. Each cylinder is isolated by check valves and has a thermal fuse, burst disc and storage relief valve which will open if system pressure is exceeded.

b. The OBIGGS inert panel is located on the pilot's overhead panel. Shutting both inboard engines down will eliminate No. 2 and No. 3 hydraulic pressure to compressor motors causing automatic OBIGGS system shutdown. Additionally, the inert panel FAIL lights will illuminate.

a
NITROGEN CYLINDERS
MINUS T-1
(87-0025)





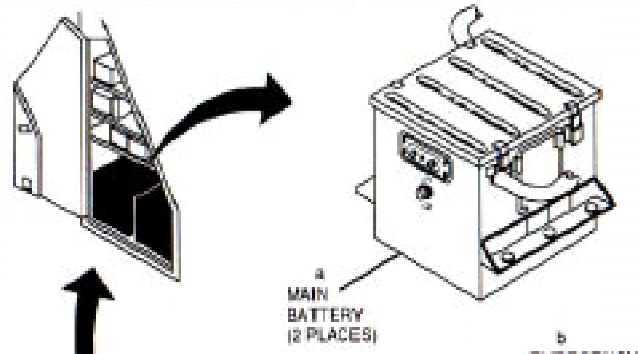
b OBIGGS
INERT PANEL

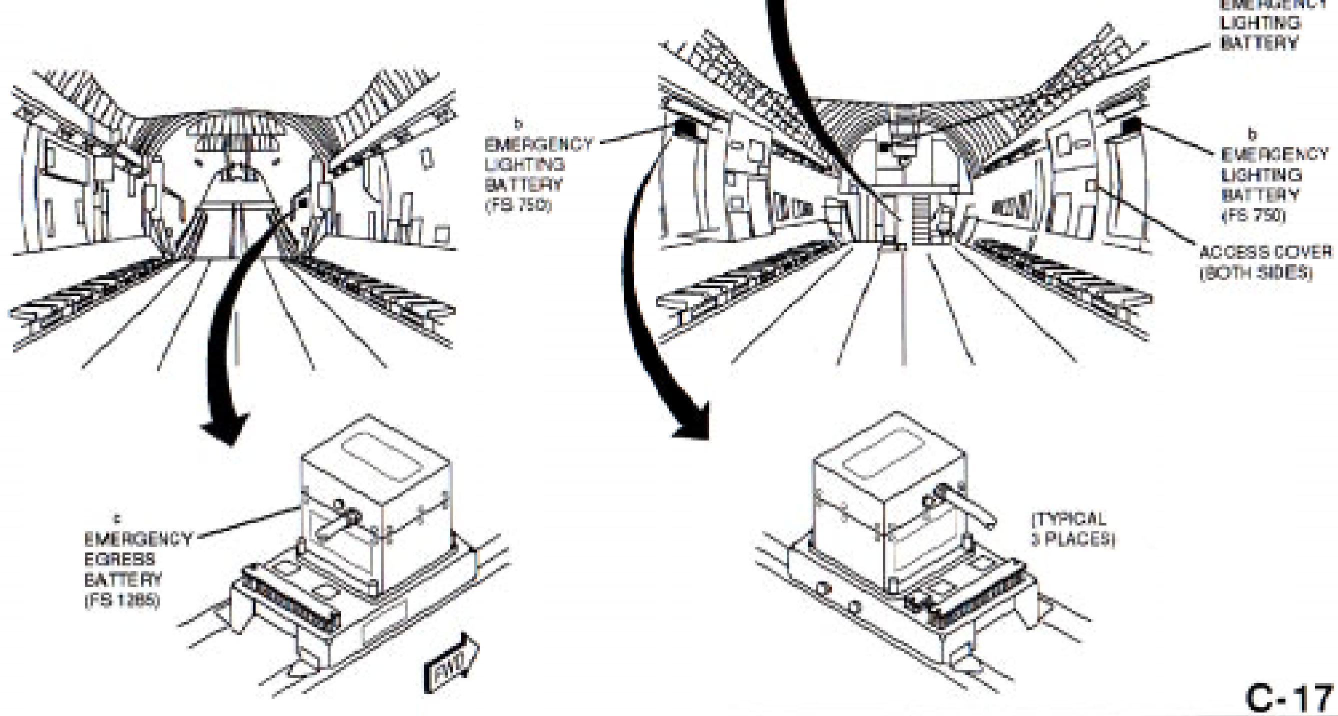
AIRCRAFT BATTERY LOCATIONS

a. Aircraft main batteries are located under the cockpit entrance stairwell in lower portion of storage cabinet.

b. Emergency lighting batteries are located on the forward bulkhead near the catwalk and on the right and left side of cargo compartment at FS 750 (behind panel).

c. Emergency egress battery is located aft of the left troop door at FS 1285 (behind panel). (Minus T-1, 87-0025)





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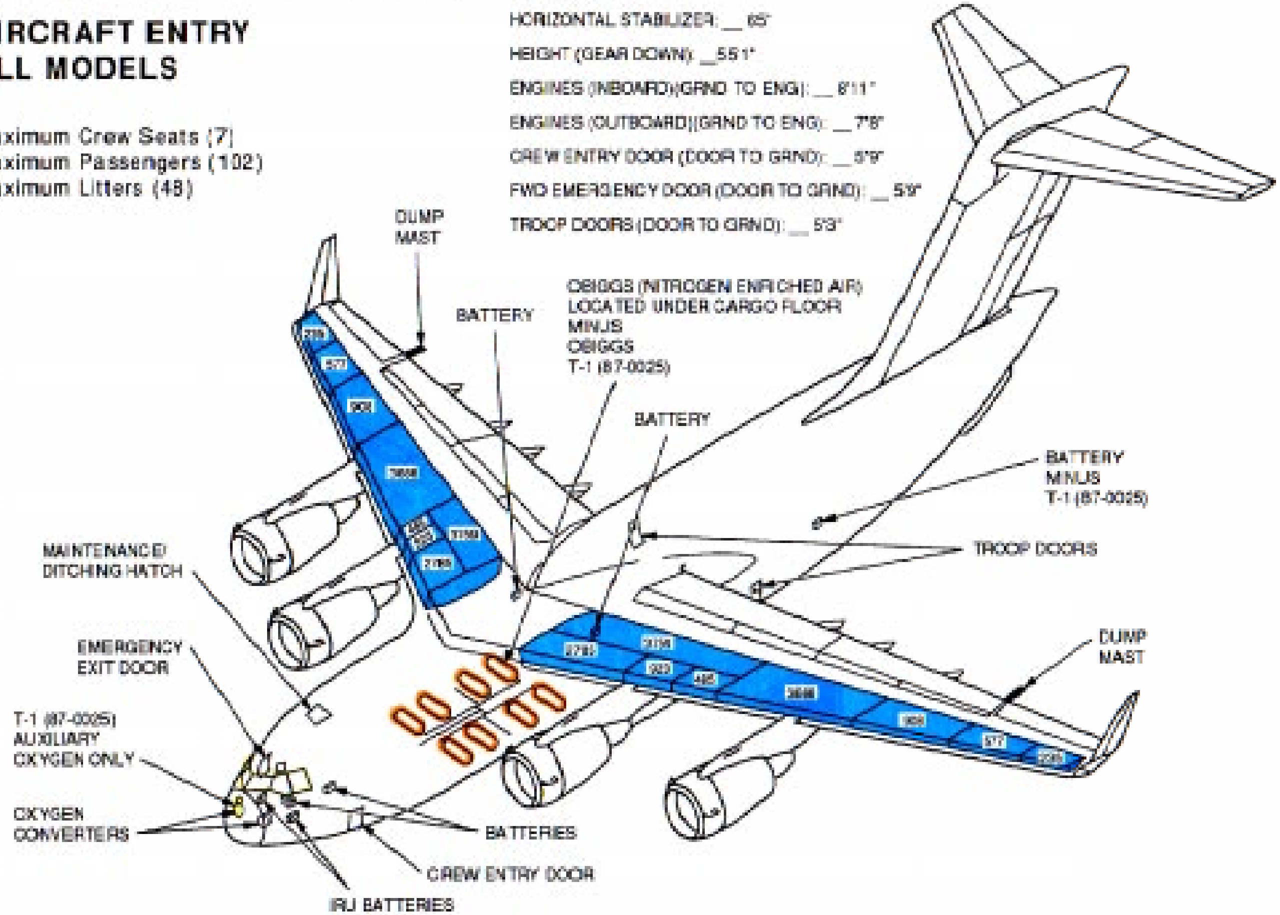
SPECIAL TOOLS/EQUIPMENT
35 Ft Extension Ladder, "A" Frame Ladder, No. 2 Phillips Screwdriver for Oxygen Access, Power Rescue Saw, Portable Lights, SPAAT Tool.

AIRCRAFT ENTRY ALL MODELS

Maximum Crew Seats (7)
Maximum Passengers (102)
Maximum Litters (48)

AIRCRAFT DIMENSIONS

LENGTH: __ 173'11"
WING SPAN: __ 169'9"
HORIZONTAL STABILIZER: __ 65'
HEIGHT (GEAR DOWN): __ 55'1"
ENGINES (INBOARD)(GRND TO ENG): __ 8'11"
ENGINES (OUTBOARD)(GRND TO ENG): __ 7'8"
CREW ENTRY DOOR (DOOR TO GRND): __ 5'9"
FWD EMERGENCY DOOR (DOOR TO GRND): __ 5'9"
TROOP DOORS (DOOR TO GRND): __ 5'3"



AIRCRAFT ENTRY – Continued

1. CREW ENTRY DOOR

NOTE:

The crew entry door is located on the left side of the aircraft forward of the wing.

a. EXTERNAL OPERATION

(1) Push small flap door next to door locking handle to grip handle. Pull out door locking handle to retract locking pins.

(2) Depress release lever, located next to door unlatching handle, and simultaneously pull out on unlatching handle until the release lever engages the detent to lift door over stops.

(3) Pull down on door with locking handle until retractable lower step sets on ground.

NOTE:

Door is counterbalanced to prevent free fall.

b. INTERNAL OPERATION

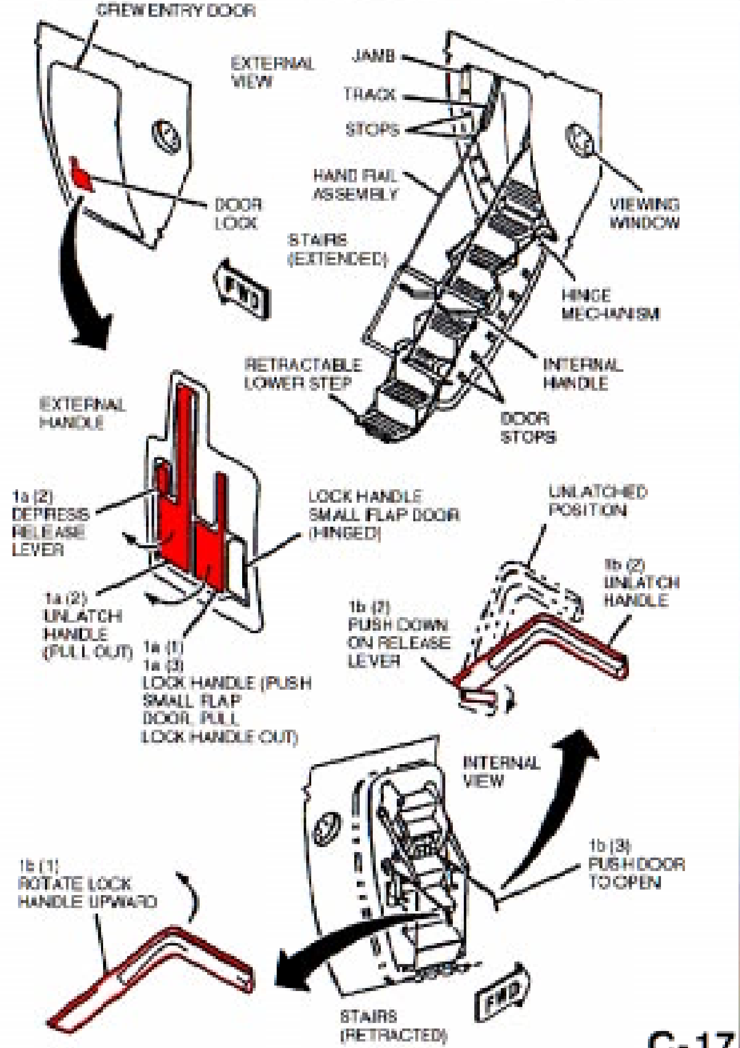
WARNING

To prevent personnel injury or damage to the door, visually clear the outside area using the viewing window adjacent to the door.

(1) Door lock handle is located adjacent to left door railing. Raise lock handle upward to unlock door.

(2) Door latch handle is located adjacent to right door railing. Push down on release lever and hold. Raise latch handle upward until the release lever engages the detent to lift door off stops.

(3) Push door open. Door will open by its own weight. Hand rails and stairs will extend automatically.



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AIRCRAFT ENTRY – Continued

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2. COCKPIT ACCESS DOOR

NOTE:
A cockpit access door is provided above the cockpit stairwell leading from the cargo compartment into the cockpit area.

a. If the access door is in the closed position, pull down on latch release and push door upward and secure against access door handrail retainer.

3. TROOP DOOR

NOTE:
A troop door is located on the left and right side of the aircraft aft of the wing root. The doors are 43 inches wide by 80 inches high, and weigh approximately 195 pounds each. The doors are counterbalanced to assist in opening and closing.

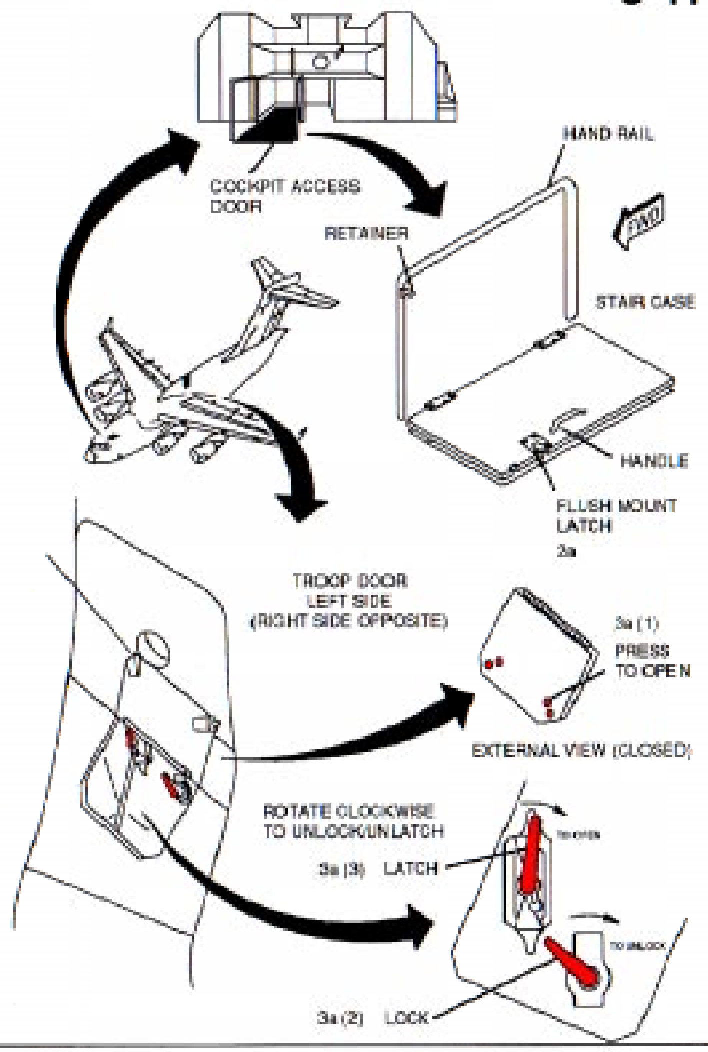
a. EXTERNAL OPERATION

(1) Open troop door control access cover by pressing quick release latch assembly push buttons.

(2) Rotate locking handle, smaller handle located in center of door, to unlock position.

(3) Rotate latching handle, located above locking handle, to unlatch position and raise door to full open position.

- On the left side of the aircraft outside handles will rotate clockwise to unlock and unlatch.
- On the right side of the aircraft outside handles will rotate counterclockwise to unlock and unlatch.



AIRCRAFT ENTRY – Continued

b. INTERNAL OPERATION

(1) Rotate the locking handle, lower small handle in center of door, to unlock position.

(2) Rotate latching handle, located above and forward of locking handle, to unlatch position and raise door to full open position.

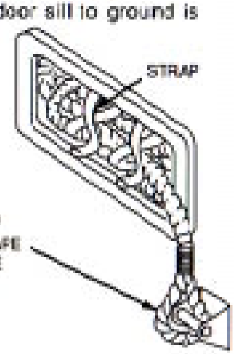
(3) Use lift handle to raise door.

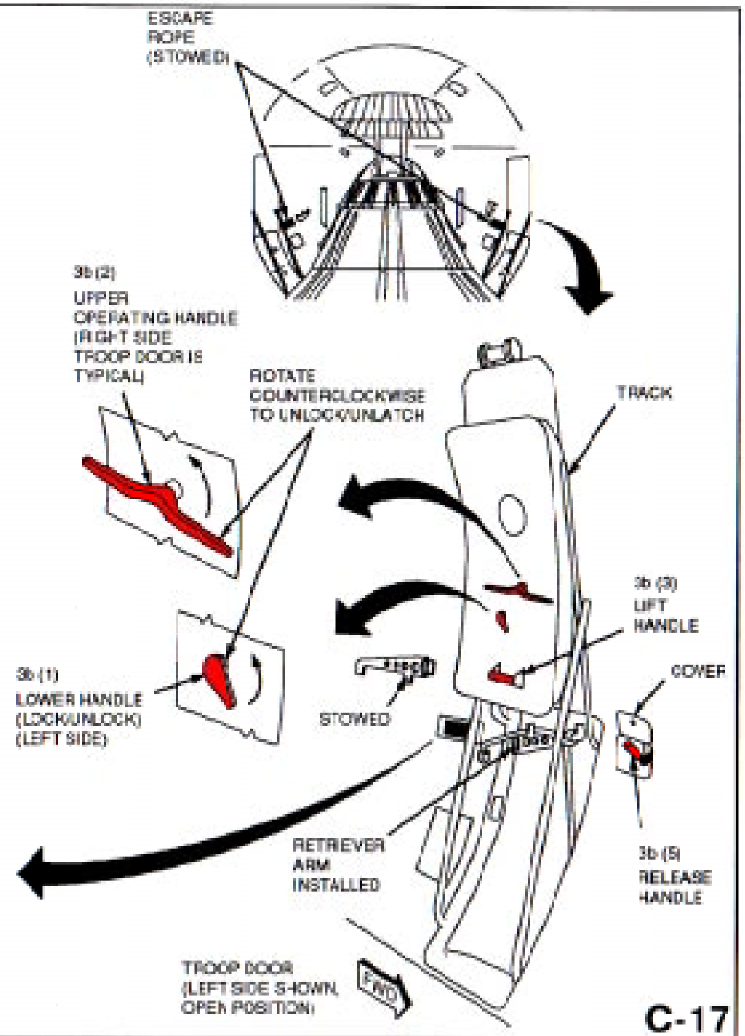
(4) Both troop doors are equipped with an egress rope and a retriever arm. Install retriever arm in retainer receptacle located on aft portion of troop door jamb. Loop rope over outboard hook for egress.

(5) To close, raise door, pull lock handle, lower door.

NOTE:

- On the left side of the aircraft inside handles rotate counterclockwise to unlock and unlatch.
- On the right side of the aircraft inside handles rotate clockwise to unlock and unlatch.
- Normal height from troop door sill to ground is approximately 5'3".





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AIRCRAFT ENTRY – Continued

C-17

4. FORWARD EMERGENCY ESCAPE DOOR

NOTE:
The forward emergency escape door is located on right side of aircraft opposite crew entry door.

a. EXTERNAL OPERATION

(1) Operating handle is recessed within door. Push in on center cover, pull external handle outward and up.

(2) Push door inboard on pivot/anchor assembly and remove as required.

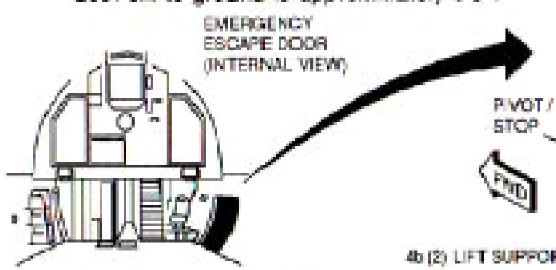
NOTE:
This is a plug type door weighing approximately 50 lbs. Door is 26 inches wide and 55 inches high.

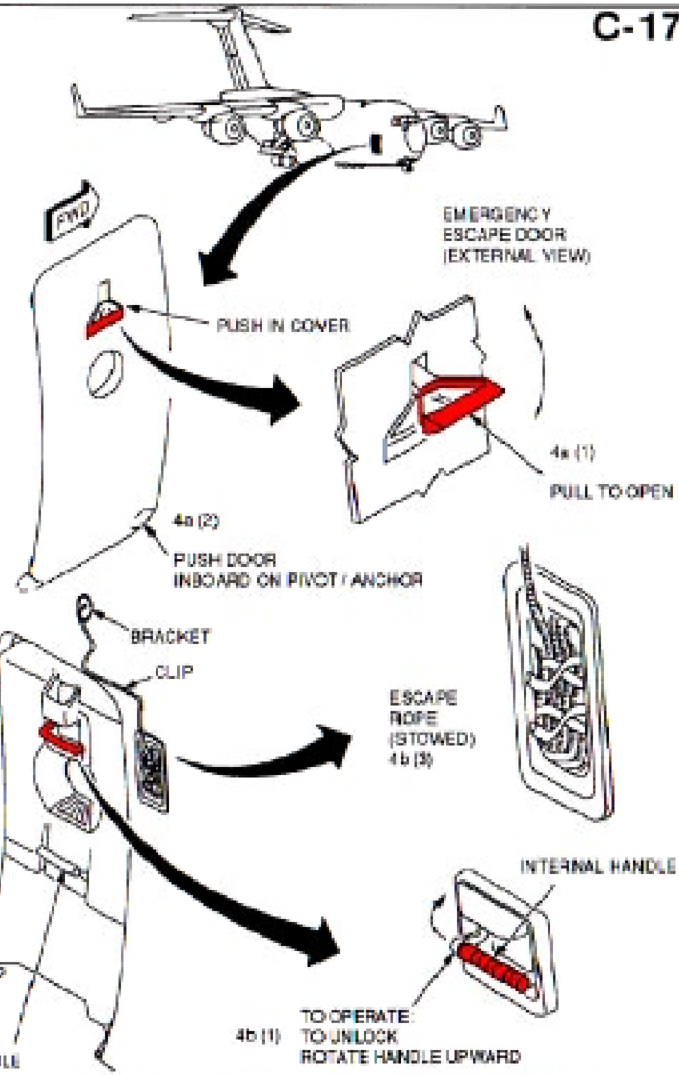
b. INTERNAL OPERATION

(1) Pull operating handle inward and up. Door will raise up off of seal.

(2) Lift door by using lift support handle inward on pivot/anchor and stow setting door to the side for egress.

(3) Pull escape rope from container and place outside door frame for egress. Height from door sill to ground is approximately 5'9".





AIRCRAFT ENTRY – Continued

5. CARGO RAMP BLOWDOWN SYSTEM (Minus T-1, 87-0025)

NOTE:
The ramp blowdown system is used to rapidly open the ramp and provide area lighting for aeromedical evacuation. The ramp blowdown system is deployed from either the forward or aft loadmaster's control panel, left side. Each control consists of two red guarded switches.

a. To initiate Blowdown sequence, raise the red guard and place arming switch to the armed position and hold.

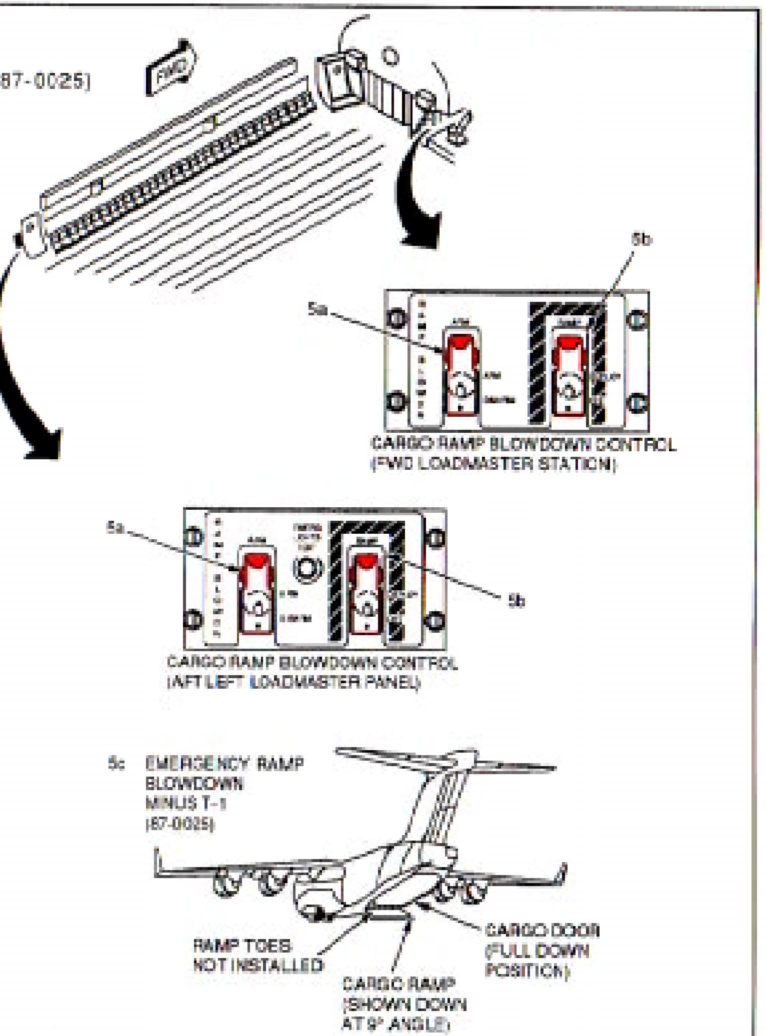
b. Raise red guard on ramp deploy activator, place and hold switch in deploy position until ramp deploys.

c. The cargo ramp will automatically deploy to the full down position. Emergency cargo ramp lights will illuminate to aid in evacuating the aircraft.

WARNING

- To prevent personnel injury and damage to equipment, ensure that personnel and equipment are clear prior to operating ramp.
- When initiating ramp blowdown, the cargo door may be locked in the down position. If cargo is center loaded on cargo ramp, evacuate litter personnel down either side of ramp. Cargo ramp toes will have been removed to facilitate evacuation of medical personnel.

NOTE:
The cargo door in the closed position allows for a vertical opening of 66 inches at centerline to 78 inches at outer edges.



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AIRCRAFT ENTRY – Continued

C-17

6. EMERGENCY CUT-IN

NOTE:

Emergency cut-in areas are provided for use if doors and hatches become jammed or inaccessible. Clearly marked areas on each side of the aircraft indicate proper locations for entry by cutting through the aircraft skin. Cut-in areas are located:

a. Aft of crew entry door on left side of the aircraft.

b. Aft of forward emergency escape door on right side of the aircraft.

c. Aft of troop door above the juncture of the cargo ramp and cargo door on the left and right sides of the aircraft.

d. Aircraft skin penetration points are limited to the center portion of the cut-in areas only.

7. SLIDING CLEARVIEW COCKPIT WINDOWS

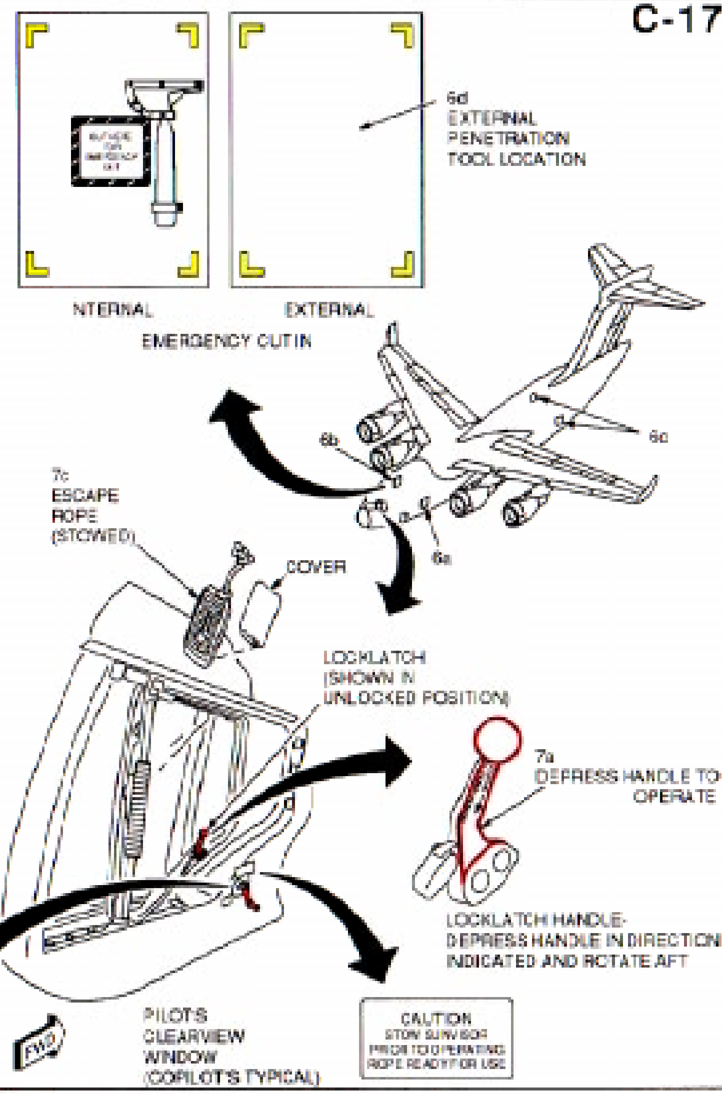
CAUTION

To prevent obstructing egress, stow the sunvisor prior to operating the clearview windows.

a. Both clearview windows are operated by depressing the locklatch lever located forward of the sliding window sill, and rotating the lever aft to unlock window.

b. To open the window, push in window crank handle to engage, and rotate handle. (Pilot's counterclockwise, Copilot's clockwise)

c. An escape rope is provided above each pilot's clearview window.





AIRCRAFT ENTRY – Continued

8. MAINTENANCE/ DITCHING HATCH

NOTE:
The maintenance/ditching hatch, located at top centerline in the crew bunk area, is a 26 inch X 26 inch manually operated plug type hatch that also serves as an egress for exterior maintenance of the aircraft. Internal access to this hatch is from the crew rest area, up the crew bunk area ladder, and to the aft end of the bunk area where another short rigid ladder aids in egress through the open hatch. Descent is made down the side of the aircraft by use of an escape rope.

a. EXTERNAL OPERATION

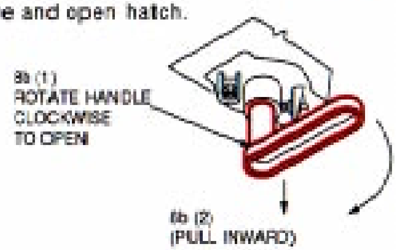
(1) Rotate handle counterclockwise to open position.

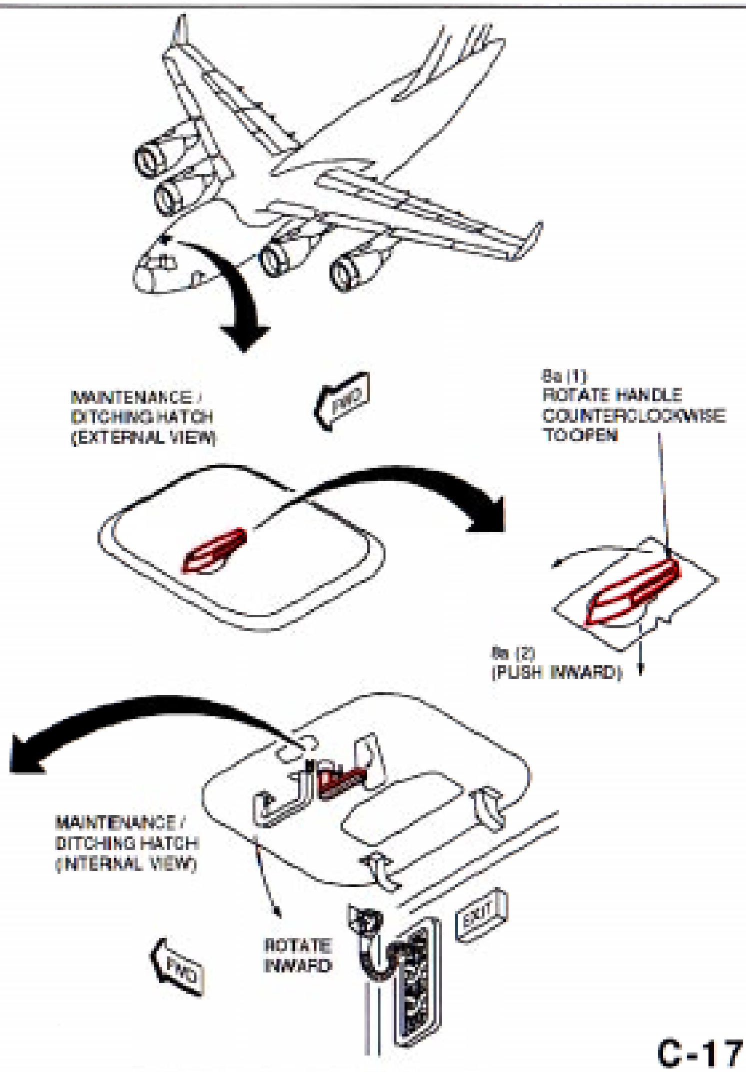
(2) Push inward to overcome hinge spring pressure and open hatch.

b. INTERNAL OPERATION

(1) Rotate handle clockwise to open position.

(2) Pull inward to overcome hinge spring pressure and open hatch.





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AIRCRAFT ENTRY – Continued

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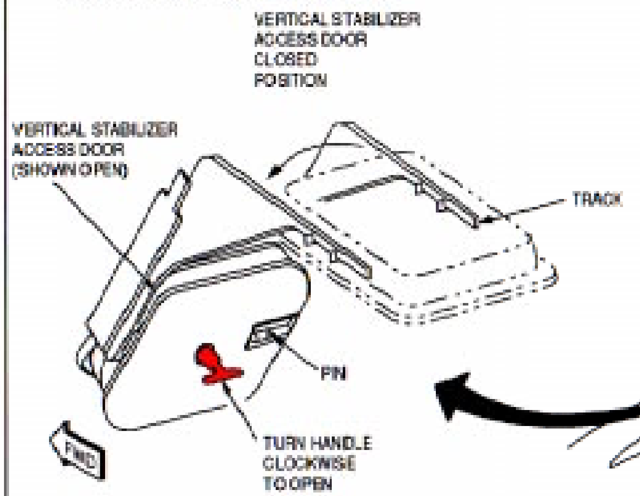
9. VERTICAL AND HORIZONTAL STABILIZER DOORS

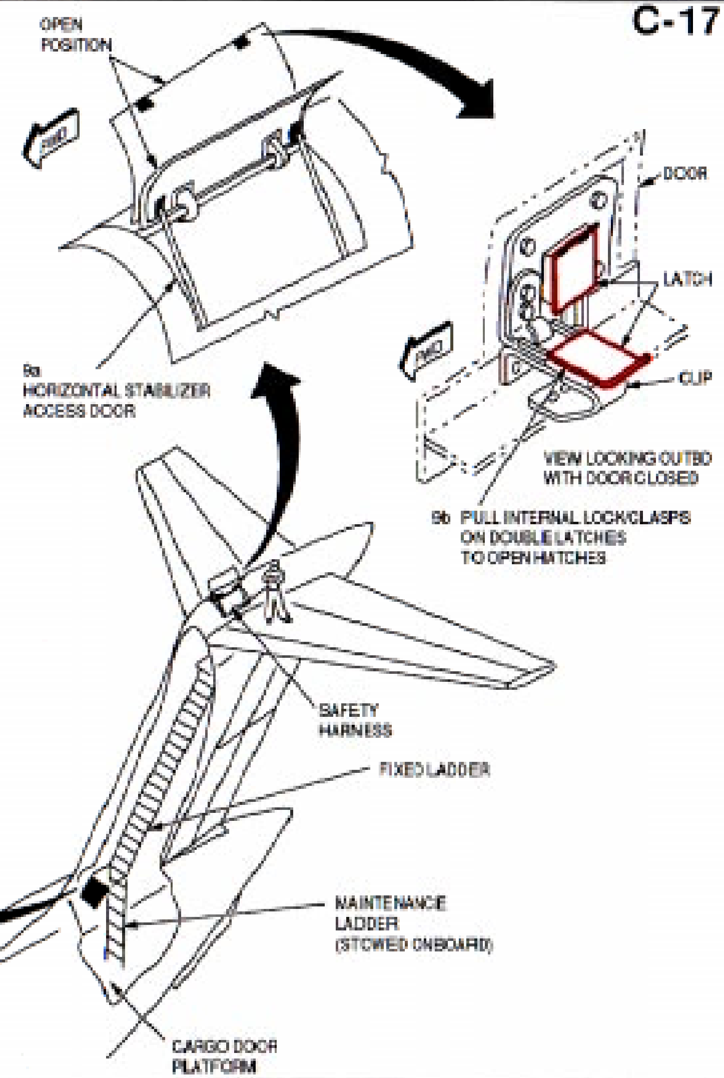
NOTE:
Vertical stabilizer access is available through a plug type door located directly above the cargo door. It provides access to the vertical stabilizer and maintenance ladder leading to the upper horizontal stabilizer access doors.

a. The horizontal stabilizer access doors located on either side of the vertical stabilizer are opened from the inside.

b. Each door is internally locked using four clasp type latches each.

c. No external access is provided.





AIRCRAFT ENTRY – Continued

10. BELLY ACCESS SERVICE HATCH

NOTE:
A belly access service hatch is provided for system maintenance under the aircraft cargo floor area.

a. EXTERNAL OPERATION

(1) Open hatch control access cover by pressing thumb release latch.

(2) Rotate latching handle (large handle) clockwise to unlatch position.

(3) Close hatch cover before sliding hatch open to prevent jamming of the hatch.

(4) Push hatch inward and slide to open position (toward right side of aircraft) ensuring hatch is retained open by spring catch.

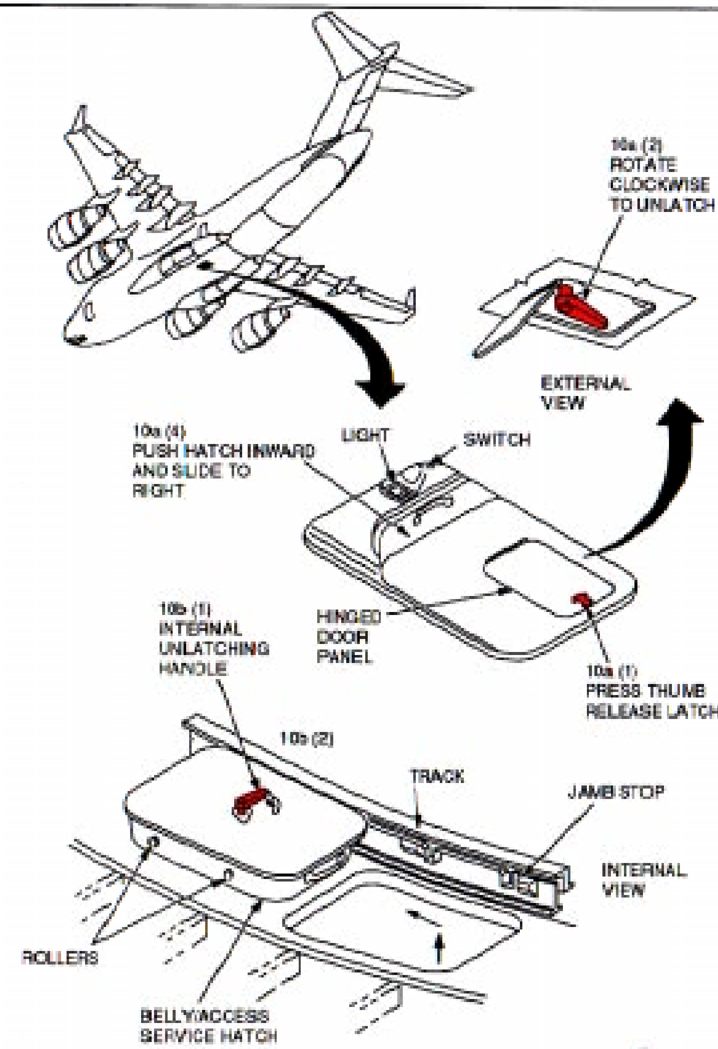
b. INTERNAL OPERATION

(1) Rotate latching handle to unlatch position.

(2) Pull hatch upward and slide open (toward right side of aircraft) ensuring hatch is retained open by spring catch.

WARNING

- Do not enter the underfloor area until it is well ventilated. Injury or death to personnel may result. Nitrogen Enriched Air (NEA) in the Onboard Inert Gas Generating System (OBIGGS) storage system could leak into the underfloor environment creating a safety hazard.
- For emergency entry, Self Contained Breathing Apparatus (SCBA) is required.



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AIRCRAFT ENTRY – Continued

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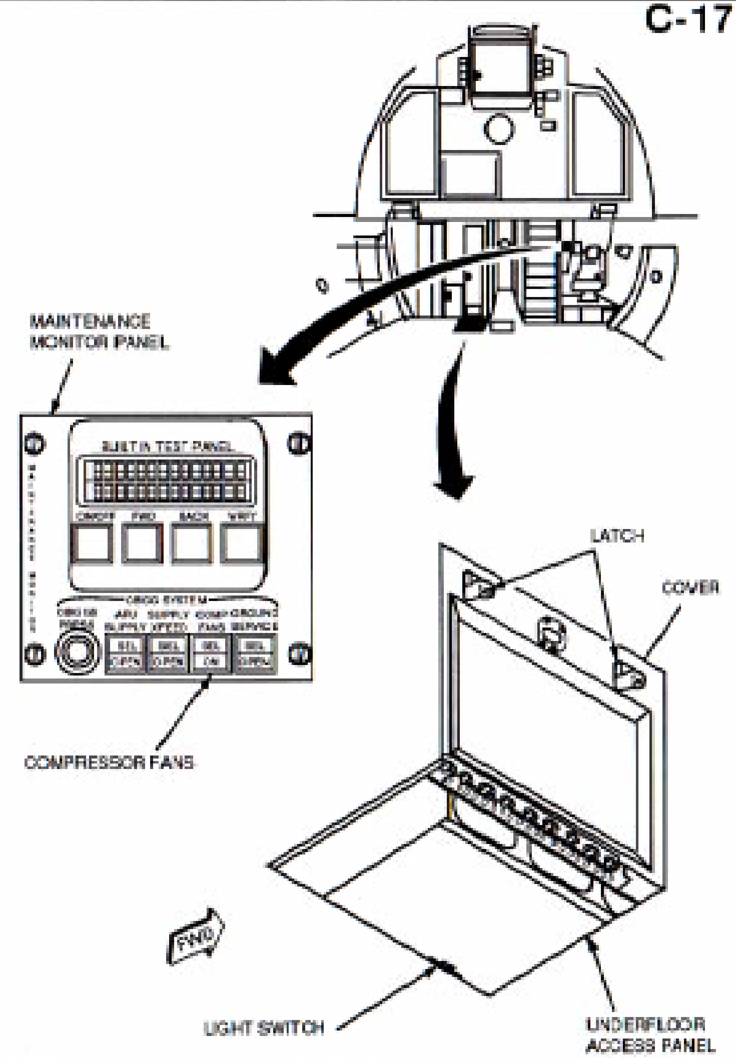
11. UNDERFLOOR ACCESS PANEL

NOTE:
Access to the underfloor maintenance area is provided through an entry in the cargo floor.

The underfloor access panel is normally in the down and closed position for flight. A panel latch is provided on the aft center ledge for opening. Once opened, the access panel will swing up 90 degrees and rest against the lavatory entrance door. No securing device is provided. An underfloor light switch is provided on the aft portion of the access entrance well.

WARNING

- Do not enter the underfloor area until it is well ventilated. Injury or death to personnel may result. Nitrogen Enriched Air (NEA) in the Onboard Inert Gas Generating System (OBIGGS) storage system could leak into the underfloor environment creating a safety hazard.
- For emergency entry, Self Contained Breathing Apparatus (SCBA) is required.



12. AUXILIARY POWER UNIT SHUTDOWN

NOTE:

Two clamshell type APU servicing doors are latched in place. A small APU inlet door provides access for servicing. No start/stop switch is located on the actual APU.

a. The APU control panel is located on pilot overhead panel, left side.

b. In case of fire, press APU OFF/ARM switchlight to shut off electrical, hydraulic, and fuel supply to APU.

c. Press AGENT DISCH switchlight to discharge fire extinguishing agent.

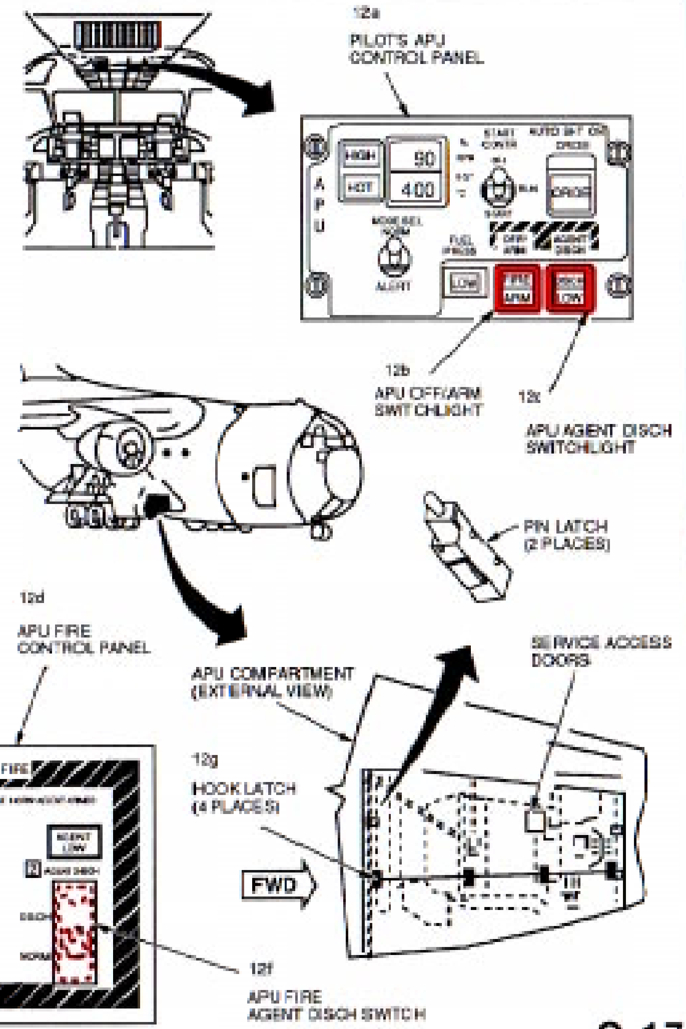
d. The two APU FIRE control panels are located on the single point refueling panel and the aft loadmaster's station, left side.

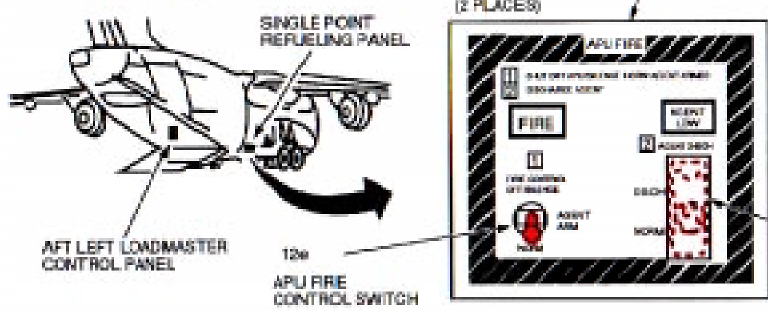
e. In case of fire, place the FIRE CONTROL switch in the OFF/SILENCE position and release to shut off the APU and arm the discharge switch.

f. Lift the switchguard and place the AGENT DISCH switch in the DISCH position to discharge the fire extinguishing agent.

g. To open full size service doors, release two thumb release pin latches and four hook latches.

(1) Open the top panel to the full up position, then install the support strut.





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13. ENGINE EMERGENCY SHUTDOWN

a. Set throttles to IDLE position.

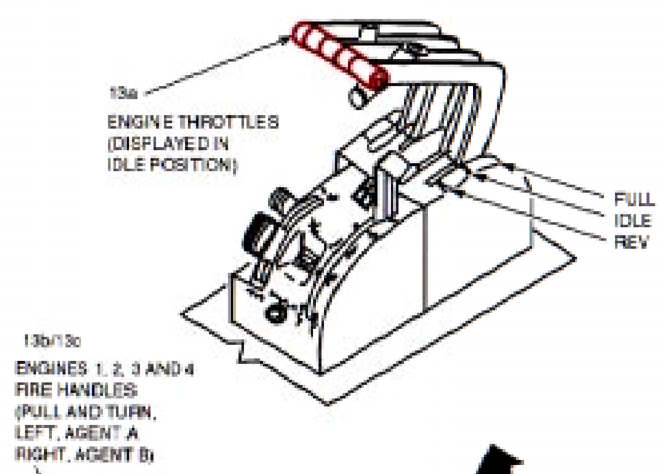
NOTE:
Do not remove battery power prior to pulling ENGINE FIRE HANDLES.

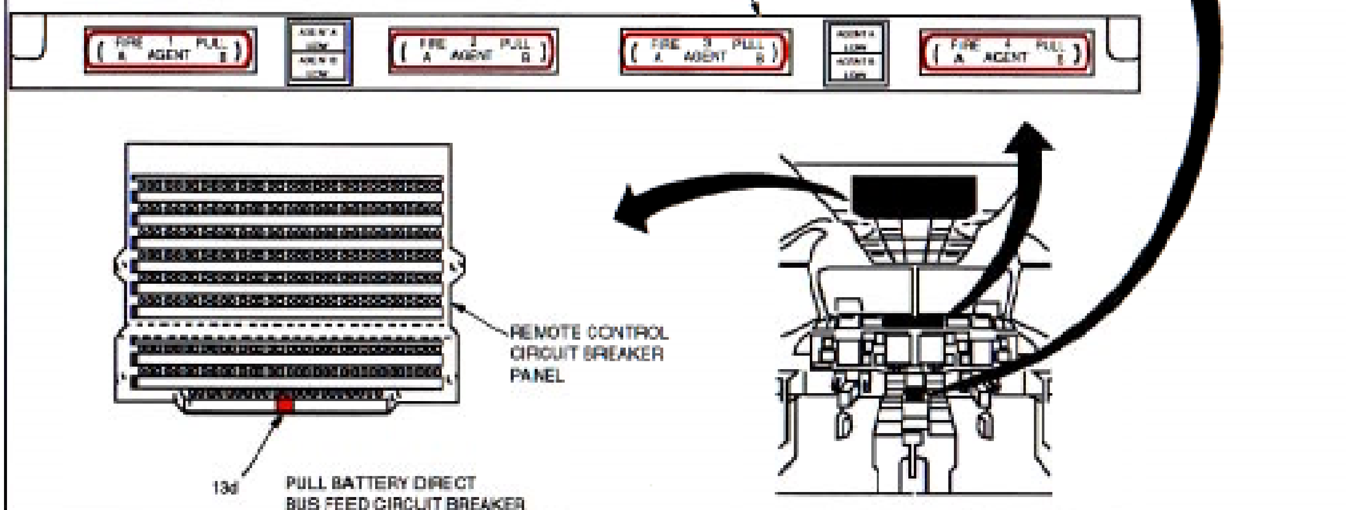
b. Pull four ENGINE FIRE HANDLES located on center portion of pilot instrument panel glareshield to shut off electrical, hydraulic, and fuel supply to engines.

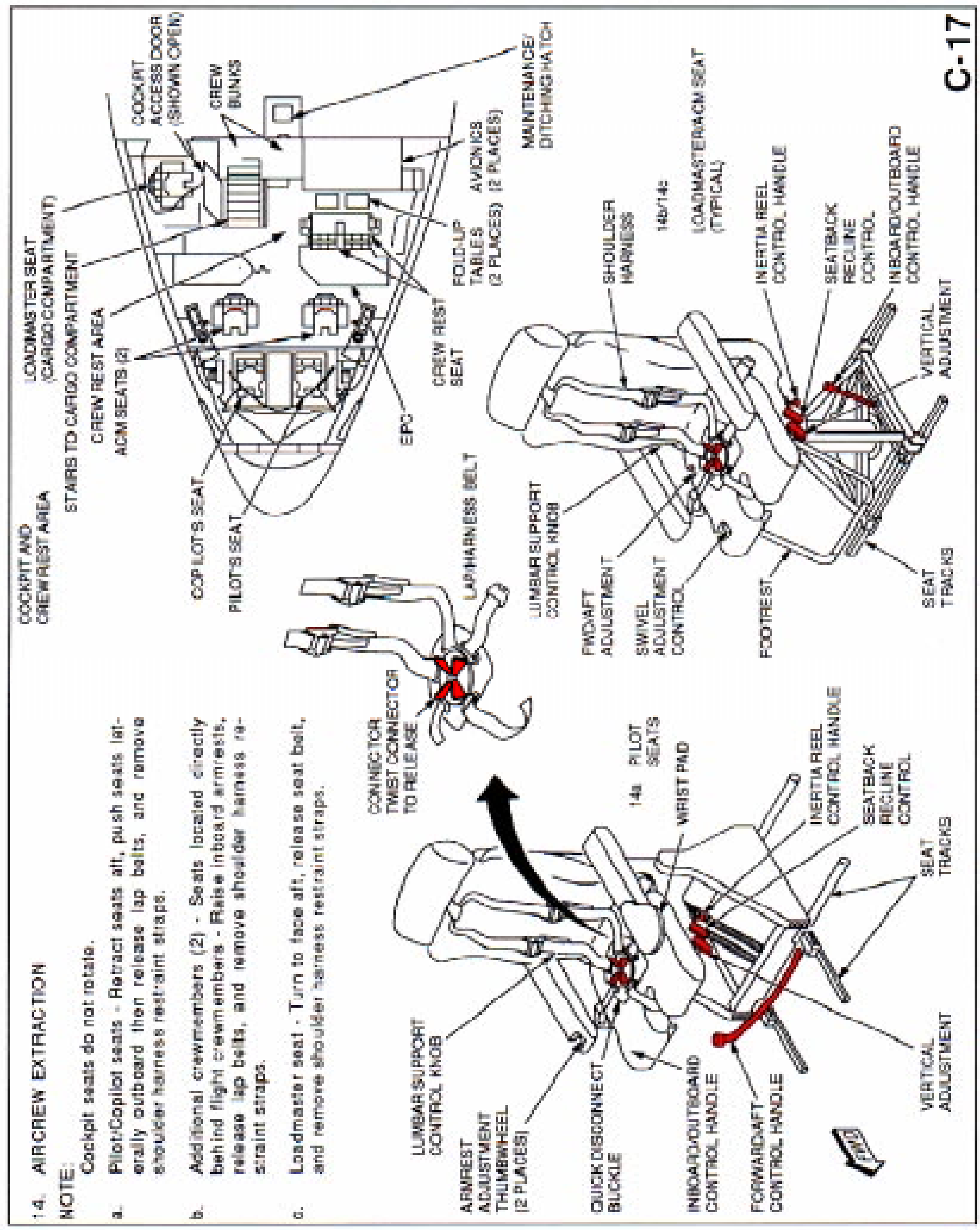
c. Turn FIRE HANDLES left, hold momentarily to release fire discharge agent A, turn FIRE HANDLES right to release agent B.

d. Pull BATTERY DIRECT BUS FEED circuit breaker located on the overhead remote circuit breaker panel Row J, Column 17 to shut down emergency battery power.

NOTE:
BATTERY DIRECT BUS FEED circuit breaker removes more electrical systems off line than the AIRCRAFT BATTERY SWITCH. Breaker can be pulled with Nomex gloves.






TO 00-105E-9

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14. AIRCREW EXTRACTION

NOTE:

Cockpit seats do not rotate.

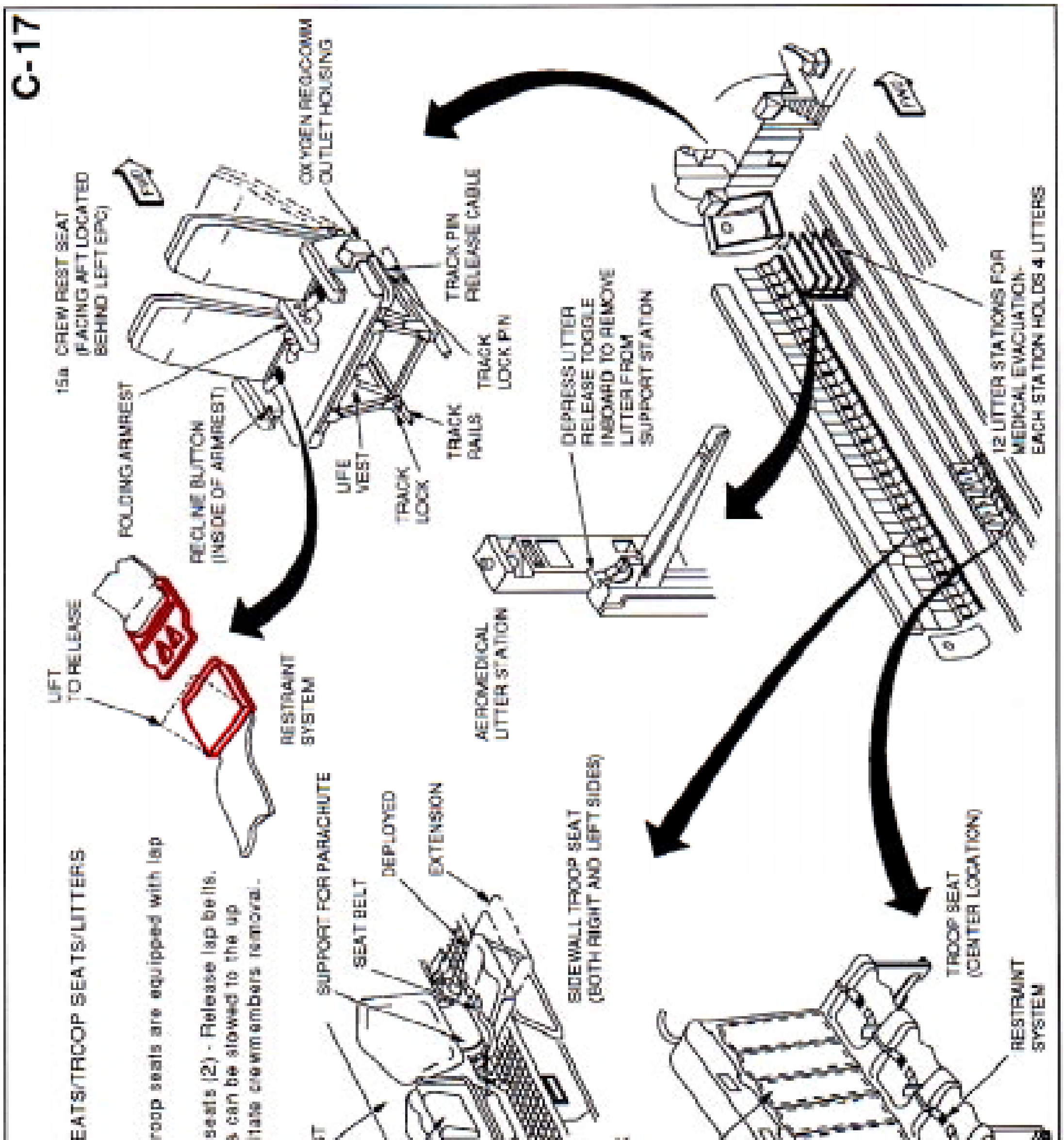
a. Pilot/Copilot seats - Retract seats aft, push seats laterally outboard then release lap belts, and remove shoulder harness restraint straps.

b. Additional crewmembers (2) - Seats located directly behind flight crewmembers - Raise inboard armrests, release lap belts, and remove shoulder harness restraint straps.

c. Loadmaster seat - Turn to face aft, release seat belt, and remove shoulder harness restraint straps.

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TO 00-105E-9



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16. PILOT AND STABILIZATION PARACHUTES

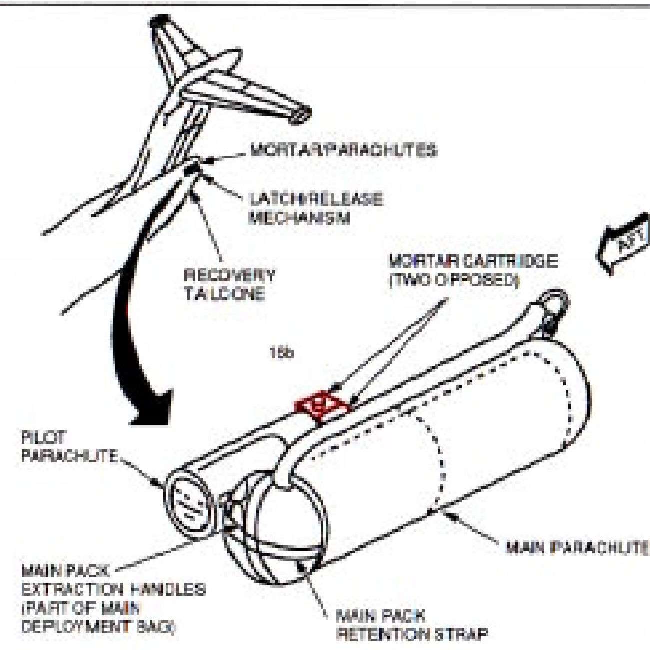
NOTE:

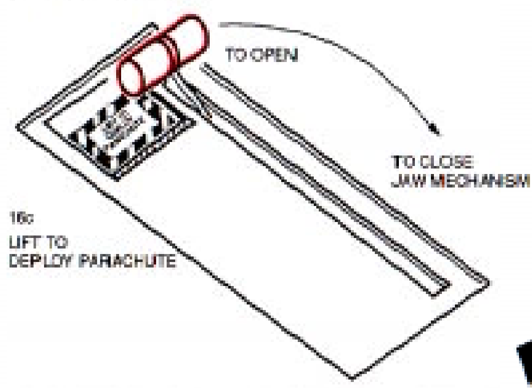
- A spin stabilization parachute system is installed for recovery requirements of the T-1 (87-0025) aircraft only. Spin stabilization chute system control panels are located on the crew center console. The parachute is located inside the flight test tailcone.
- Primary and secondary mortar firing circuits are powered by the battery direct bus.

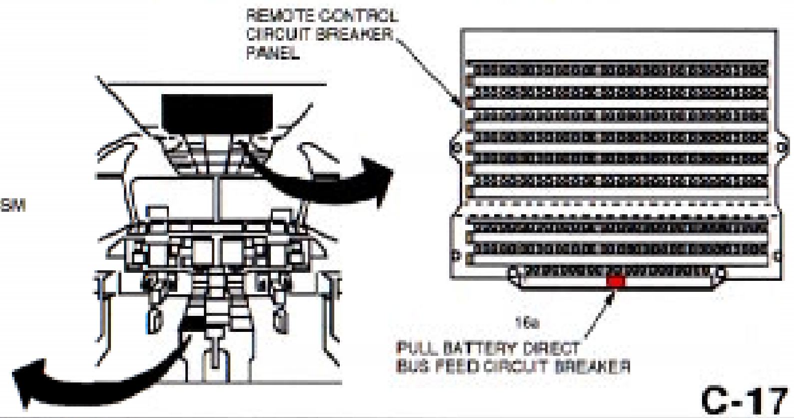
a. Pull the battery direct bus feed circuit breaker located on the pilot overhead panel marked remote circuit breaker panel. This will disengage emergency power to the battery direct bus.

b. The stabilization parachute system consists of cockpit controls, mortar, pilot parachute, main parachute, latch/release mechanism, secondary release system and recovery tailcone.

c. The cockpit controls, located on the pilot's side of the center console, include an engage light and mortar firing switch. Ensure handle is forward to prevent accidental activation.







C-17

C-17

17. T-1 (TEST AIRCRAFT) SERIAL NUMBER 87-0025

NOTE:

The C-17 test aircraft (T-1) incorporates specific test equipment; airspeed nose boom, trailing cone, escape slide (crew evacuation) system, hydraulic flutter vanes outboard of the winglets and outboard of the horizontal stabilizer. Additionally, a stabilization parachute system is located at the aft portion of the fuselage.

T-1 dimensions - aircraft length with noseboom and stabilization chute: 200' - wingspan with flutter vanes: 175'.

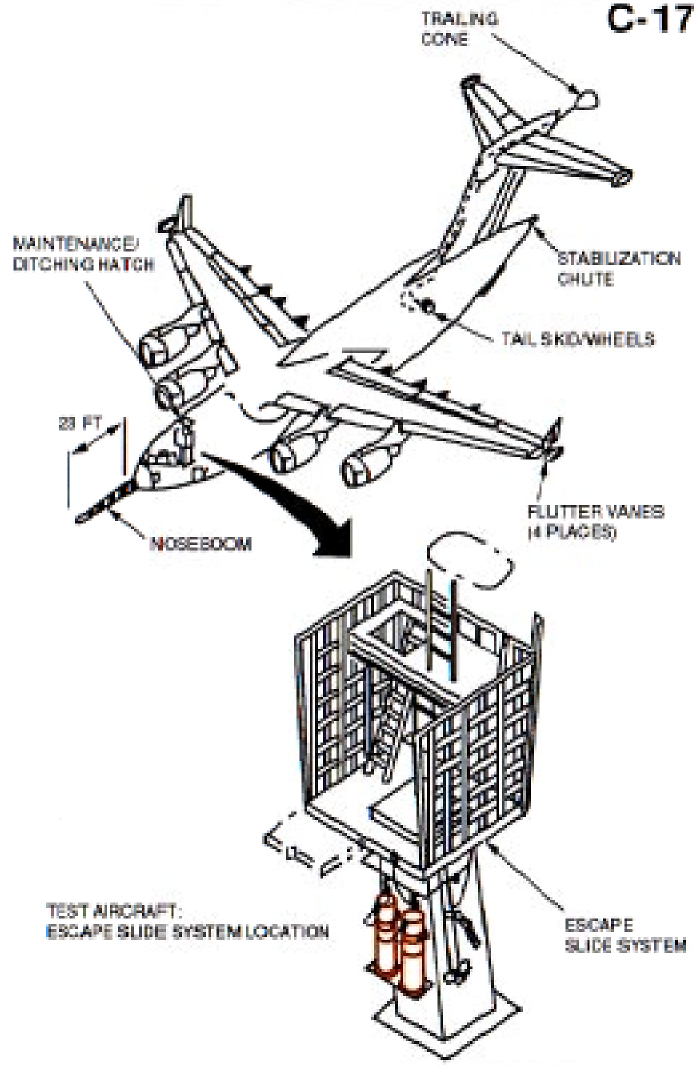
18. T-1 ESCAPE SLIDE SYSTEM

Four pyrotechnic devices are installed on the escape slide system.

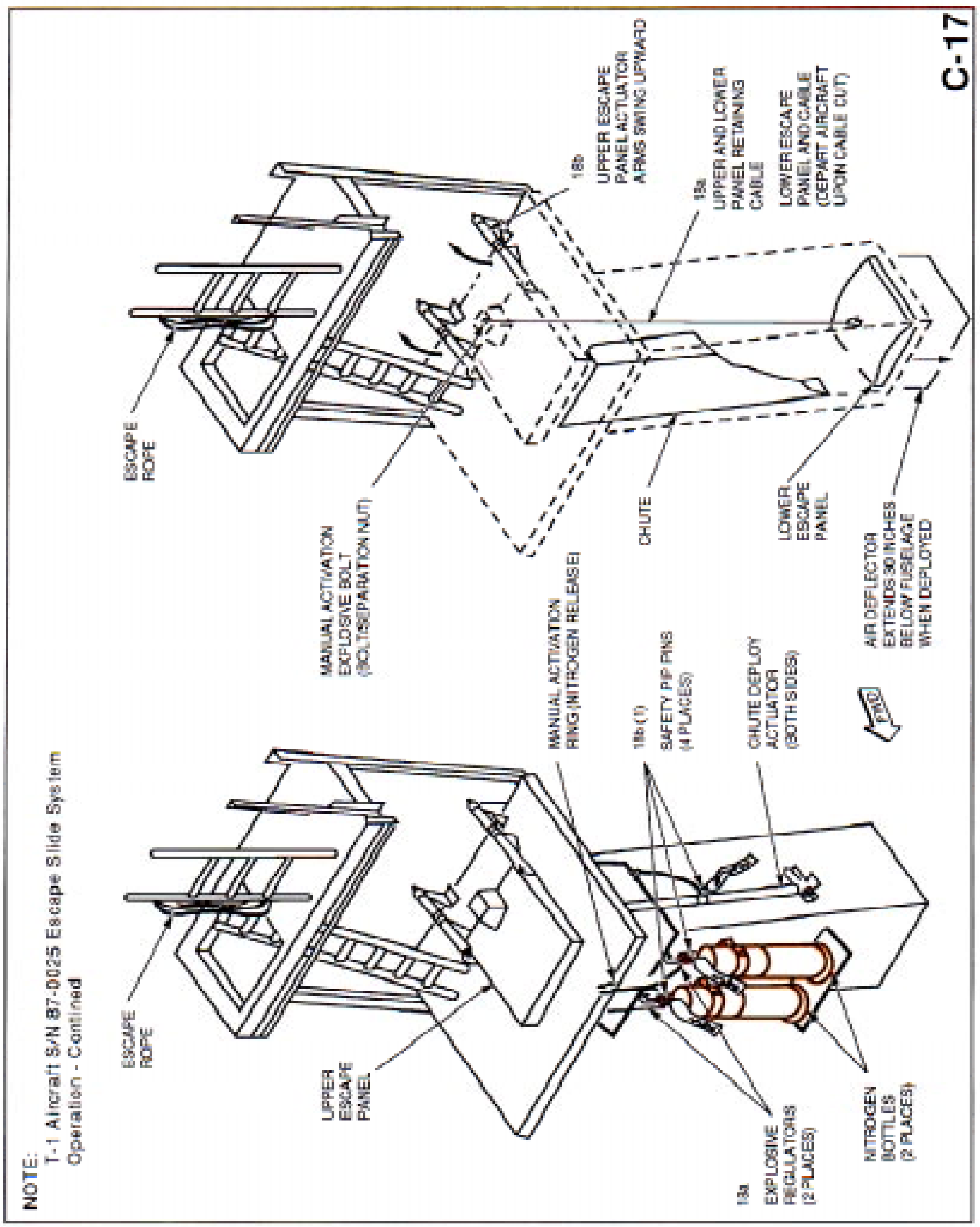
a. Two of the pyrotechnic devices are used to cut the cable which hold the upper and lower escape panels together in the closed/stowed position. Once cut, the cable and lower escape panel depart the aircraft.

b. The remaining two pyrotechnic devices activate two nitrogen bottles that pressurize the upper escape panel actuator arms. This causes the upper panel to swing upward opening the top portion of the escape chute. The retaining pins that support the air spoiler is then sheared releasing the spoiler thirty inches below the aircraft fuselage.

(1) Four safety pip pins prevent inadvertent deployment or the escape slide system.



TO 00-105E-9



6-57

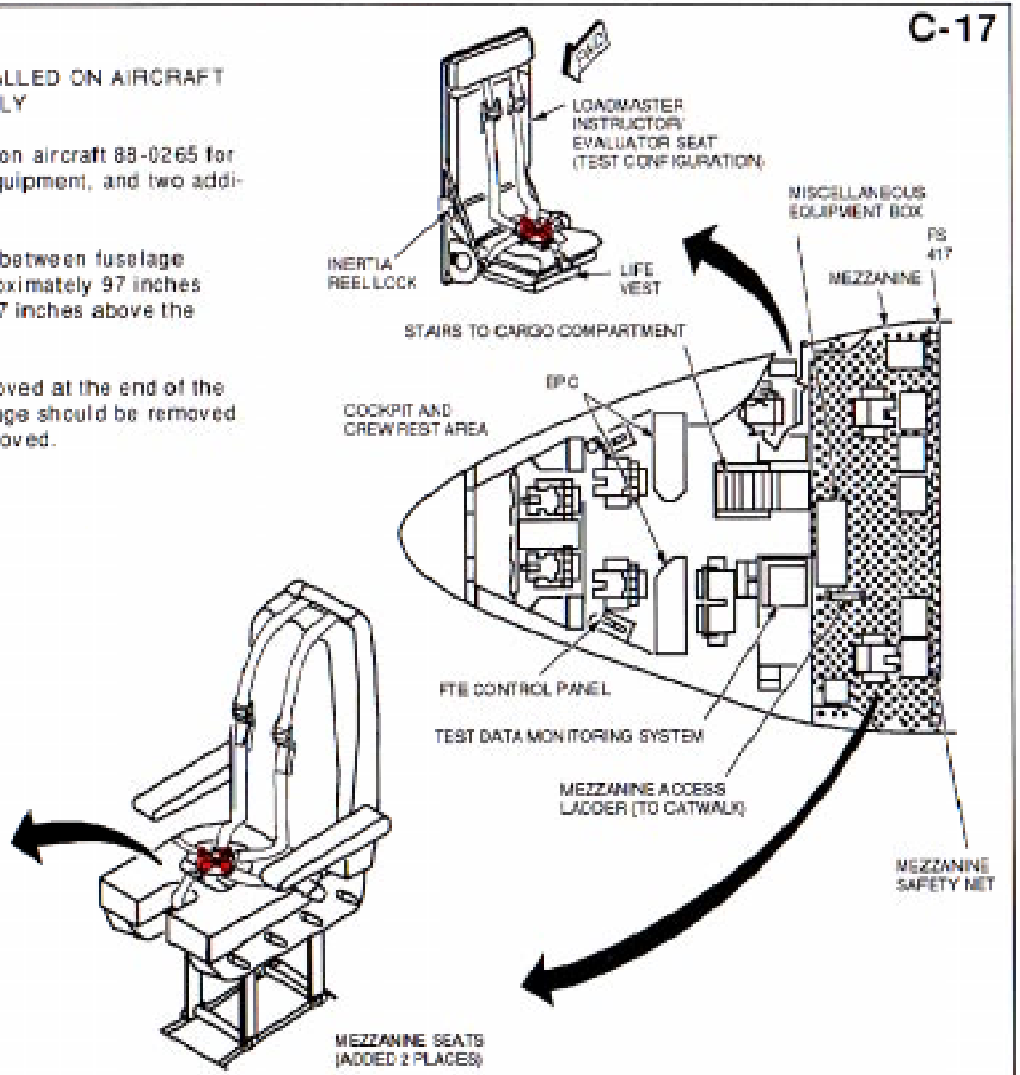
C-17

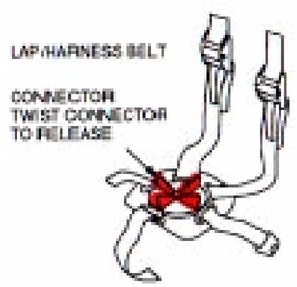
19. MEZZANINE FLOOR INSTALLED ON AIRCRAFT TAIL NUMBER 88-0265 ONLY

The mezzanine is installed on aircraft 88-0265 for the stowage of flight test equipment, and two additional crew seats.

The mezzanine is installed between fuselage stations 340 and 418, approximately 97 inches above the cargo floor, and 7 inches above the cockpit floor.

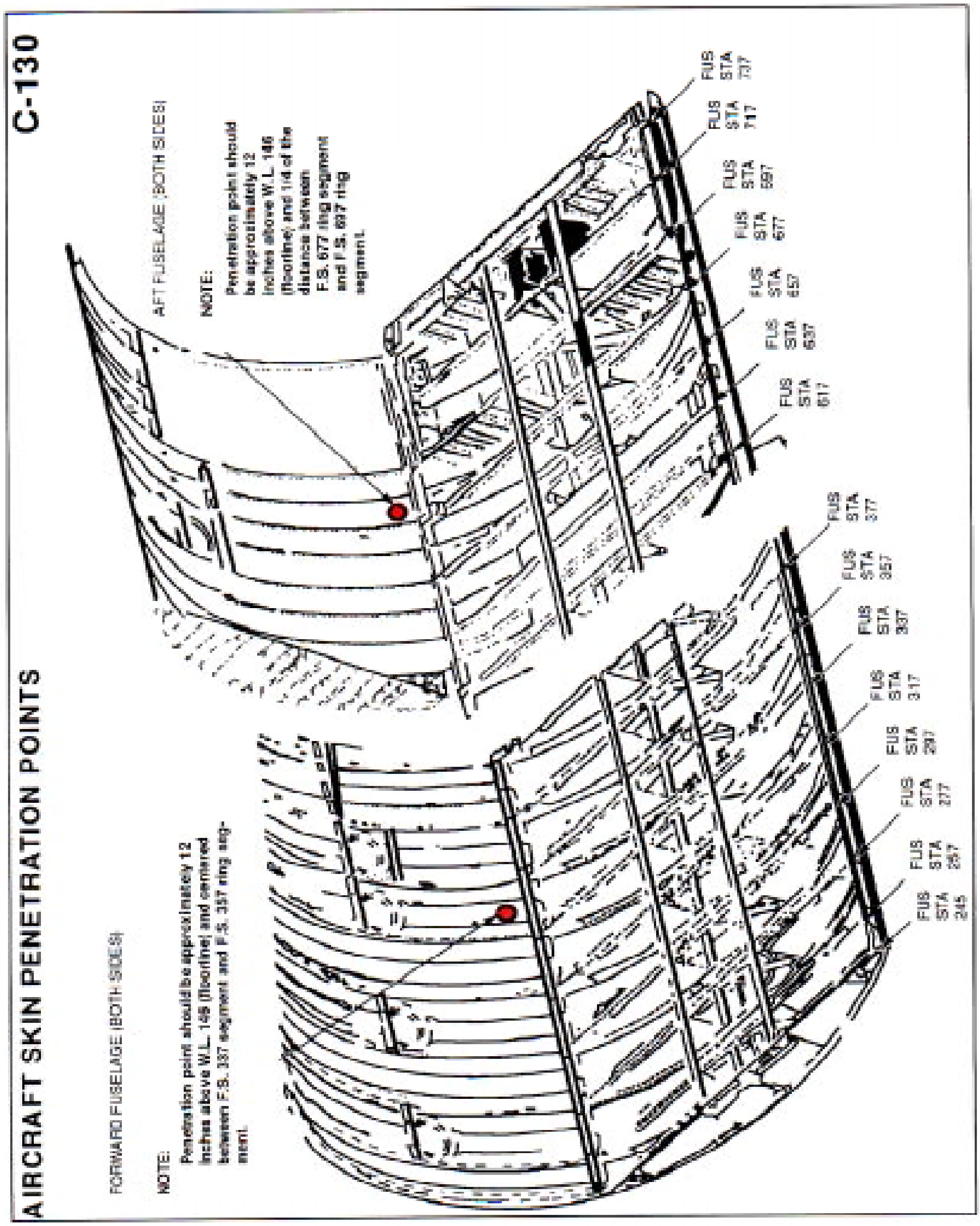
The mezzanine will be removed at the end of the flight test program. This page should be removed when the mezzanine is removed.





C-130 Hercules

TO 00-105E-9

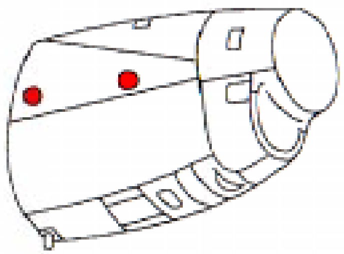


6-90

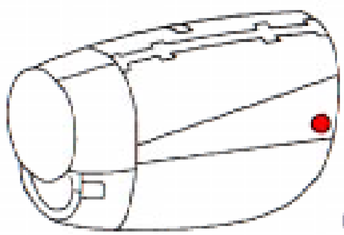
AIRCRAFT SKIN PENETRATION POINTS - Continued

NOTE:
Penetration points are the same on all 4 engine nacelles

C-130B/E/H, HC-130B/H/N/P LC-130H



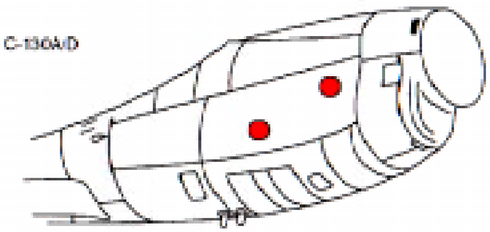
RIGHT SIDE



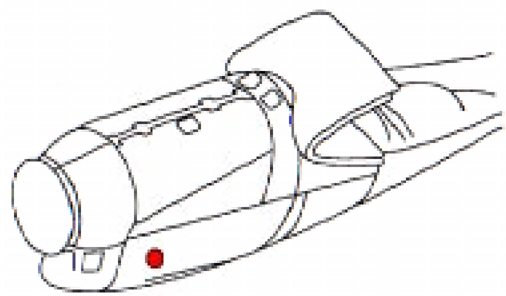
LEFT SIDE

NOTE:
Aircraft Dimensions
Length 97' 9"
Wing Span 132' 7"
Height 38' 3"

C-130A/D



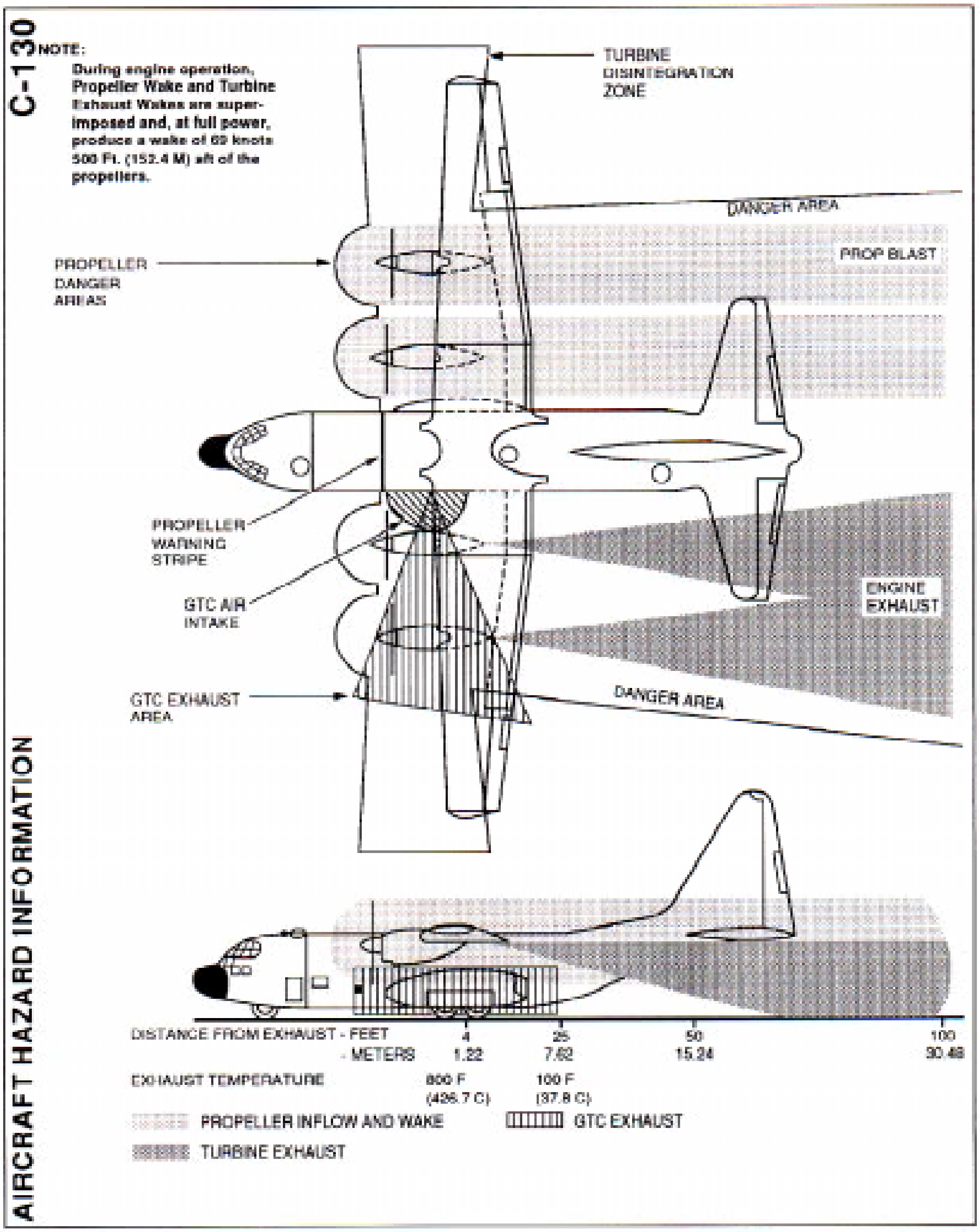
RIGHT SIDE



LEFT SIDE

C-130

TO 00-105E-9



6-92

SPECIAL TOOLS/EQUIPMENT
Power Rescue Saw

AIRCRAFT ENTRY ALL MODELS

1. NORMAL ENTRY

WARNING

Forward hatch (2a), right side of fuselage, is in close proximity of right inside turbo propeller. Avoid if propeller/engine is running. This hazard could cause loss of life! Not for entry or aircrew extraction until engine is shut-down. Same for left side if applicable model is in use.

NOTE:
On AC-130 aircraft equipped with interior electronic compartment, gain entry using troop door right aft side of aircraft.

a. Rotate crew entry door handle, located forward left side of fuselage, counterclockwise and open door outward and down.

b. Rotate troop door handle, located aft on both sides of fuselage, clockwise and push door inward and up until locked in open position.

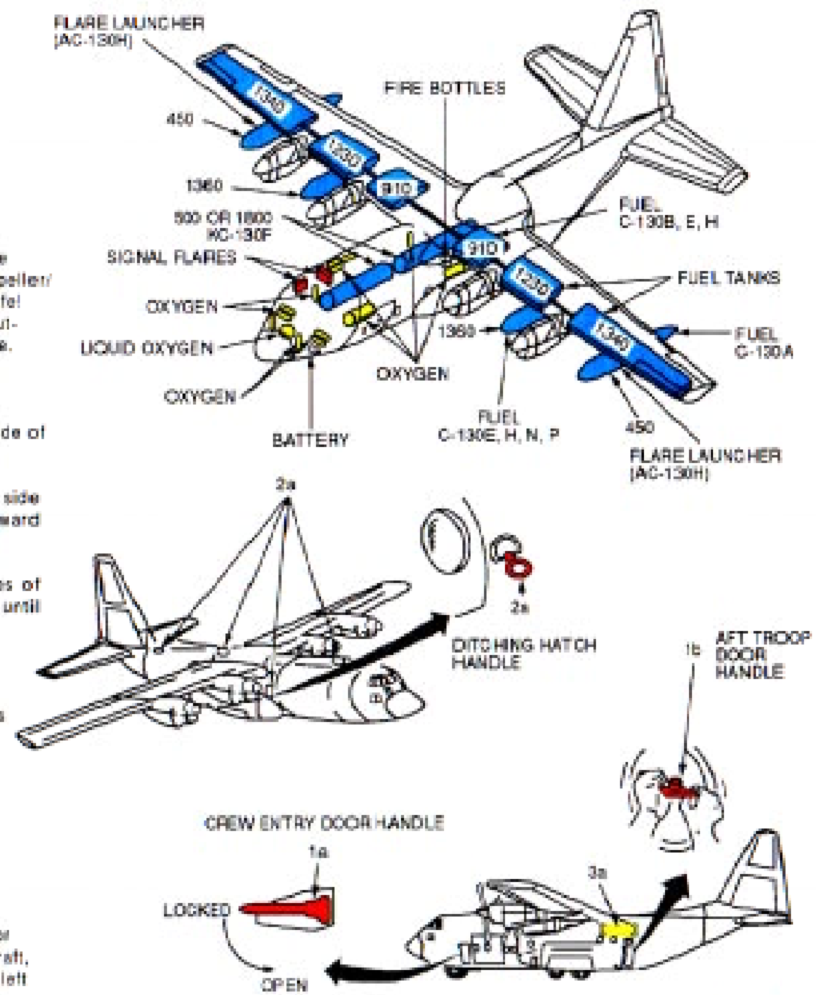
2. EMERGENCY ENTRY

a. Pull release handle and push inward on four hatches located forward, center, and aft top of fuselage, and fuselage forward right side.

3. CUT-IN

a. Cut-in areas are located on each side of fuselage, above and forward of each troop door.

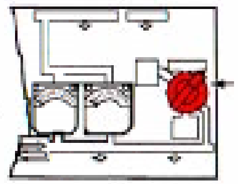
NOTE:
On HC-130H/N/P aircraft, right emergency entry door may be blocked by an equipment bin. On these aircraft, an identical emergency entry door is located on the left side of the aircraft.

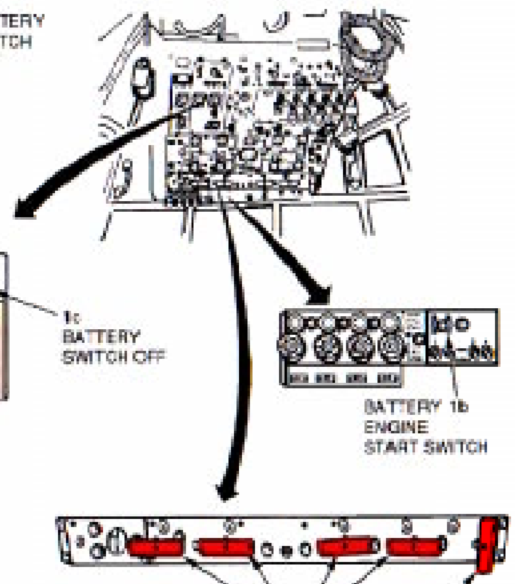


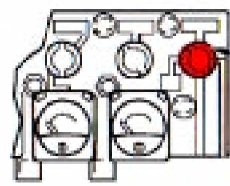
C-130

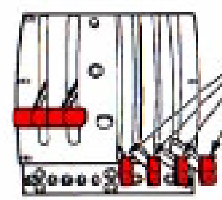
ENGINE SHUTDOWN AND AIRCREW EXTRACTION

C-130









WARNING

To avoid the hazards in approaching running aircraft, enter through rear troop doors.

NOTE:

DO NOT remove battery power before activating emergency T-handles.

1. ENGINE SHUTDOWN

a. Position condition levers, located on control pedestal between forward crew seats, aft to FEATHER position. Open safety guard of bus-tie switch. Turn switch to ON position.

NOTE:

If switch is left in OFF position, pulling T-handles will only arm fire extinguishing system and not close valves at engine fire walls. Bus-tie is located on overhead panel above pilot's right seat arm rest.

b. Pull fire emergency shutdown T-handles, located on overhead panel, to the aft position. On the C-130A pull fire emergency shutdown T-handles. Depress and hold battery engine start switch, located below and between #1 and #2 T-handles for 5 seconds, then release battery engine start switch.

NOTE:

If APU/GTC is operating, pull GTC T-Handle.

c. Disconnect battery, located forward of crew entrance door or turn battery switch, located on overhead control panel, clockwise to OFF position. On the C-130A turn switch counterclockwise to OFF position.

2. AIRCREW EXTRACTION

a. Release latch on lap belt and remove shoulder harness from crewmember(s).

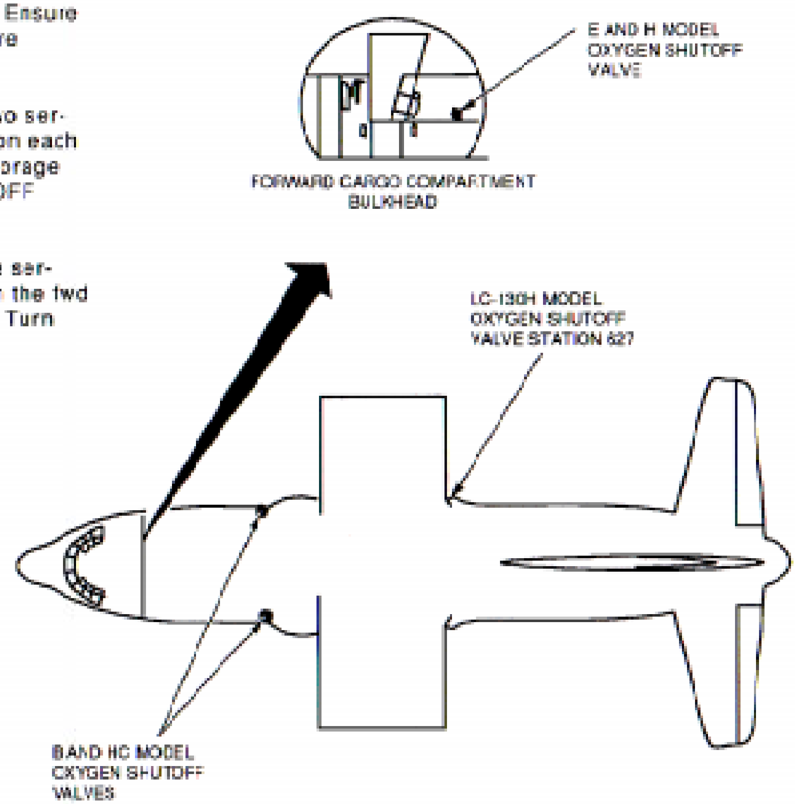
NOTE:

If seat track is not damaged during crash landing, use adjustable seat control to move seat in aft position when removing crewmember. Passenger seats do not have shoulder harness.

ENGINE SHUTDOWN AND AIRCREW EXTRACTION - Continued

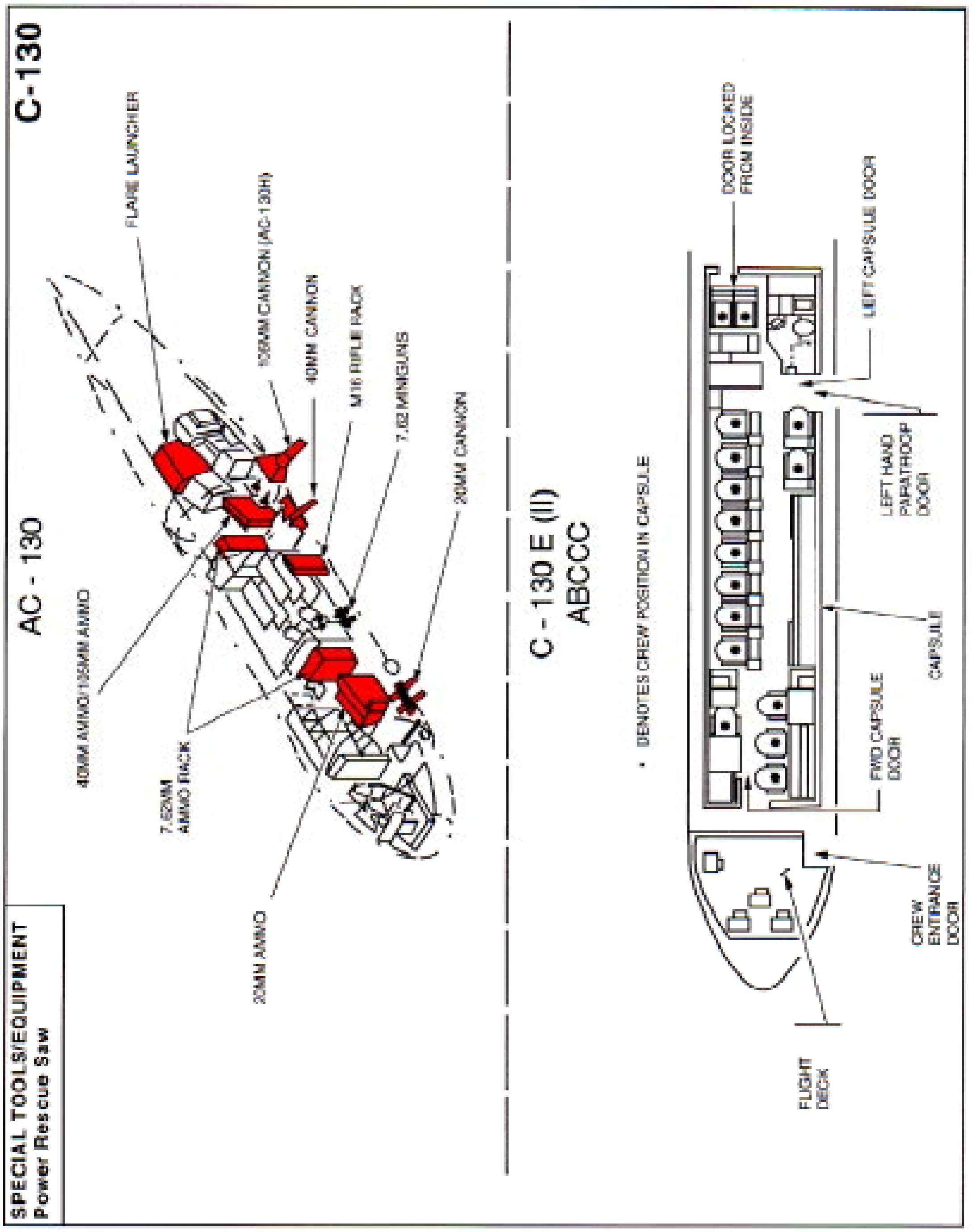
NOTE:

- To reduce fire damage in the cockpit area CLOSE oxygen manual supply valve(s). Ensure all occupants have been evacuated before closing valve(s).
- On B and HC model aircraft they have two serrated knob shutoff valves. One located on each side of the fuselage directly below the storage cylinders. Turn knobs clockwise to the OFF position.
- On E and H model aircraft they have one serrated knob shutoff valve. It is located on the fwd cargo compartment bulkhead right side. Turn knob clockwise to the OFF position.



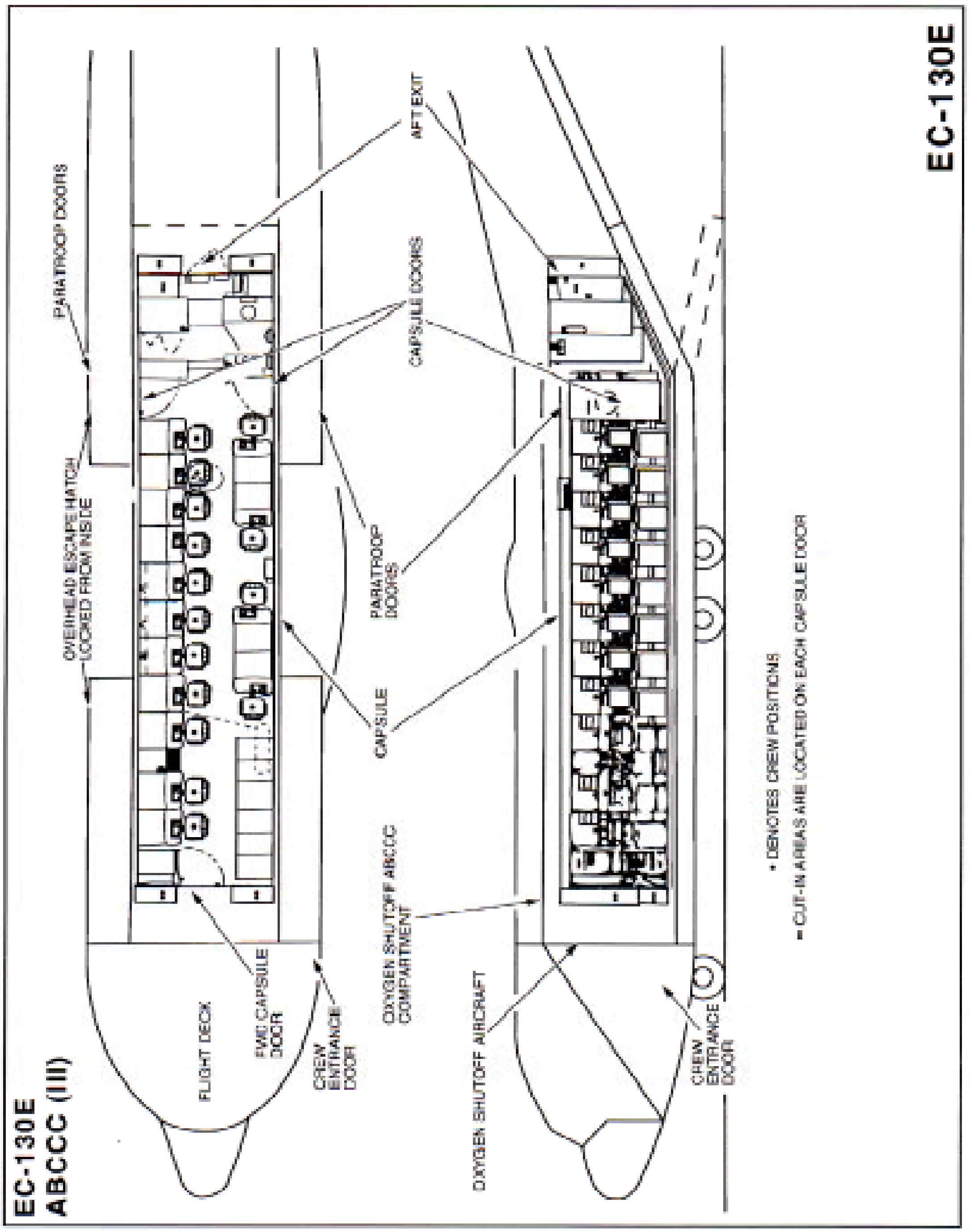
C-130

TO 00-105E-9



6-96

TO 00-105E-9



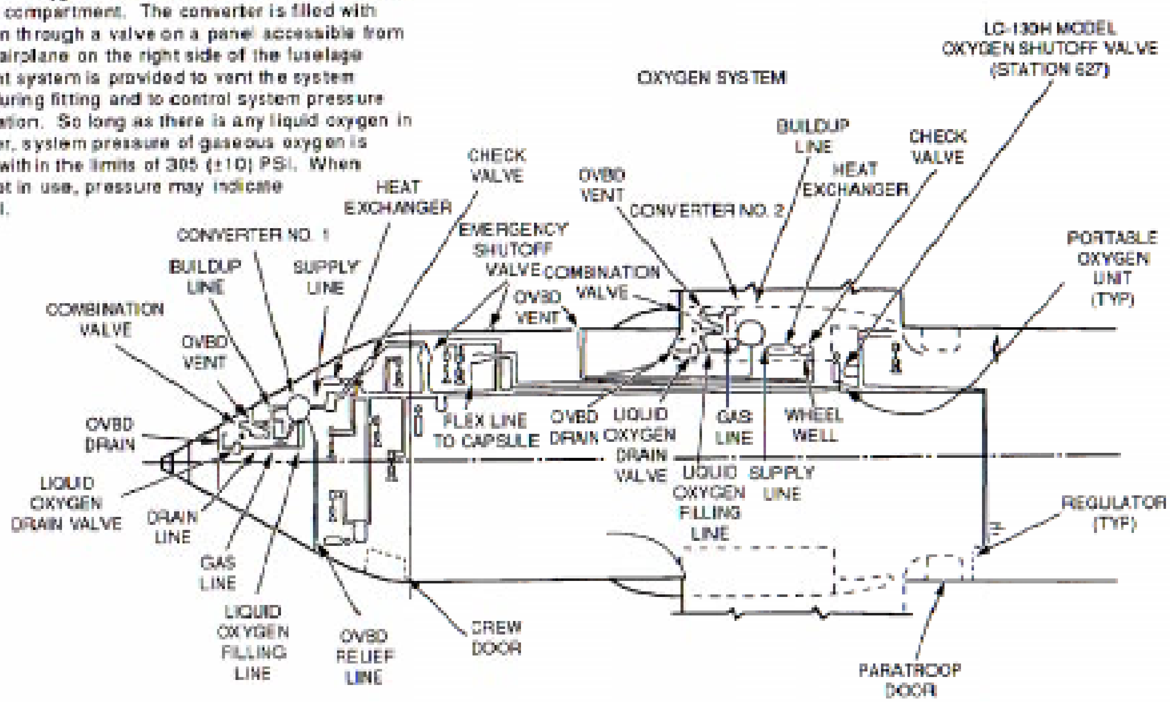
6-97

EC-130E

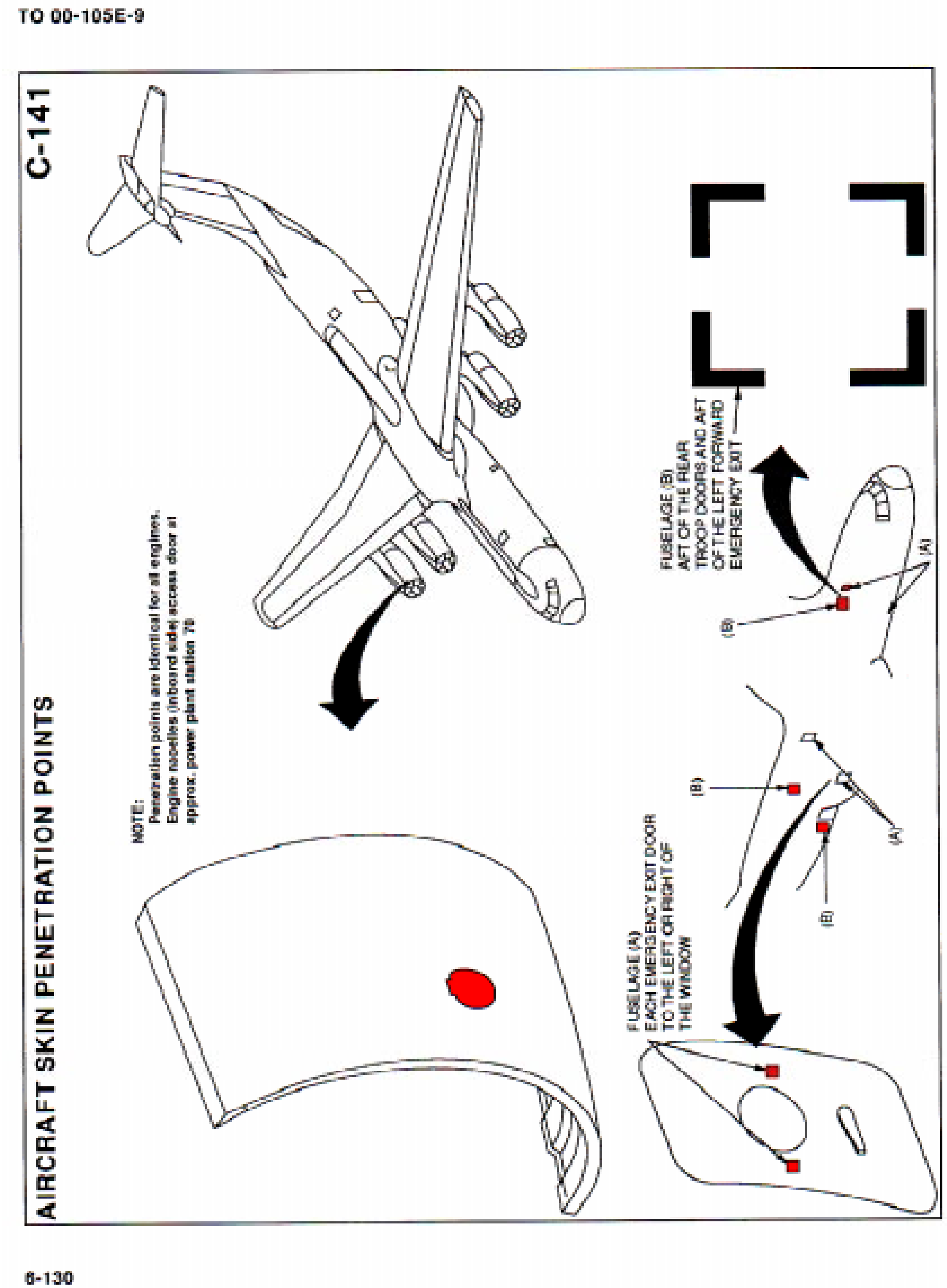
EC-130E ABCCC (III) – Continued

NOTE:

The oxygen supply of the C-130E and H airplanes is carried in a liquid oxygen converter of 25 litre capacity, shock mounted in the right side of the nose wheel well. A capacitance-type liquid oxygen quantity indicating system is provided, with a gage on the copilot's side of the main instrument panel, together with a low level warning light. The converter supplies gaseous oxygen to a system consisting of plumbing lines connected to ten regulators and four recharging connections. The regulators are located in the flight station and cargo compartment at potential crew stations. Two recharging connections from which portable oxygen bottles can be refilled, are located in the cargo compartment. The converter is filled with liquid oxygen through a valve on a panel accessible from outside the airplane on the right side of the fuselage nose. A vent system is provided to vent the system overboard during filling and to control system pressure during operation. So long as there is any liquid oxygen in the converter, system pressure of gaseous oxygen is maintained within the limits of 305 (±10) PSI. When system is not in use, pressure may indicate 380-430 PSI.



C-141 Starlifter



AIRCRAFT HAZARD INFORMATION

WARNING

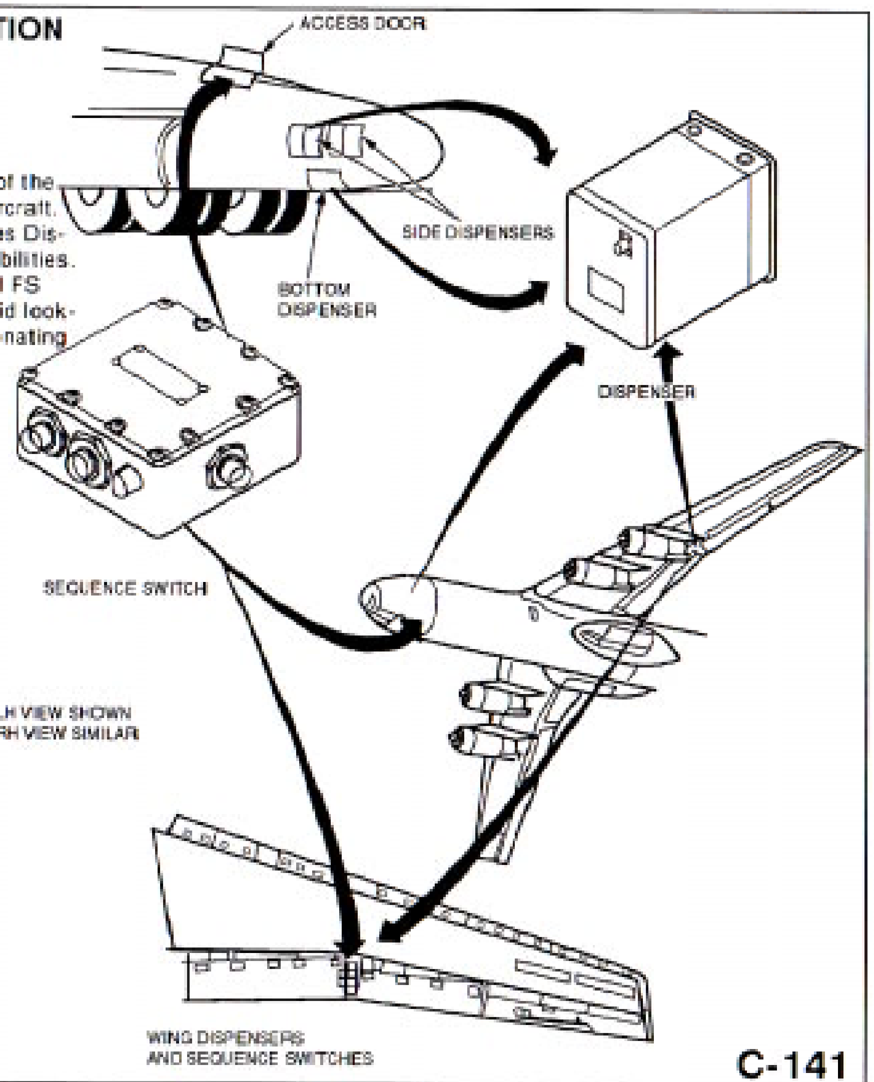
Flares are a source of ignition for many of the lubricants and fluids used in servicing aircraft. Selected aircraft have a Countermeasures Dispensing System or flare dispensing capabilities. These devices are located in FS 520 and FS 1130E on both sides of the aircraft. Avoid looking in the direction of the burning or detonating magnesium incendiaries. Stray voltage can cause ignition. Personnel should ground themselves prior to approaching these critical areas.

Affected
Tail numbers:

64-619
64-649
65-266
65-269
65-273
65-279
65-618
65-0271
66-174
66-196
66-202
67-0012
67-0026

C-141 Special Operations
Low Level (SOLL):

66-131
67-0014



C-141

C-141

SPECIAL TOOLS/EQUIPMENT
Power Rescue Saw
Extension Ladder, 24 Ft

AIRCRAFT ENTRY ALL MODELS

1. NORMAL ENTRY - CREW DOOR, TROOP DOORS

a. Pull T-handles, one forward left side and two aft, one on each side of fuselage, out and rotate clockwise.

2. EMERGENCY ENTRY

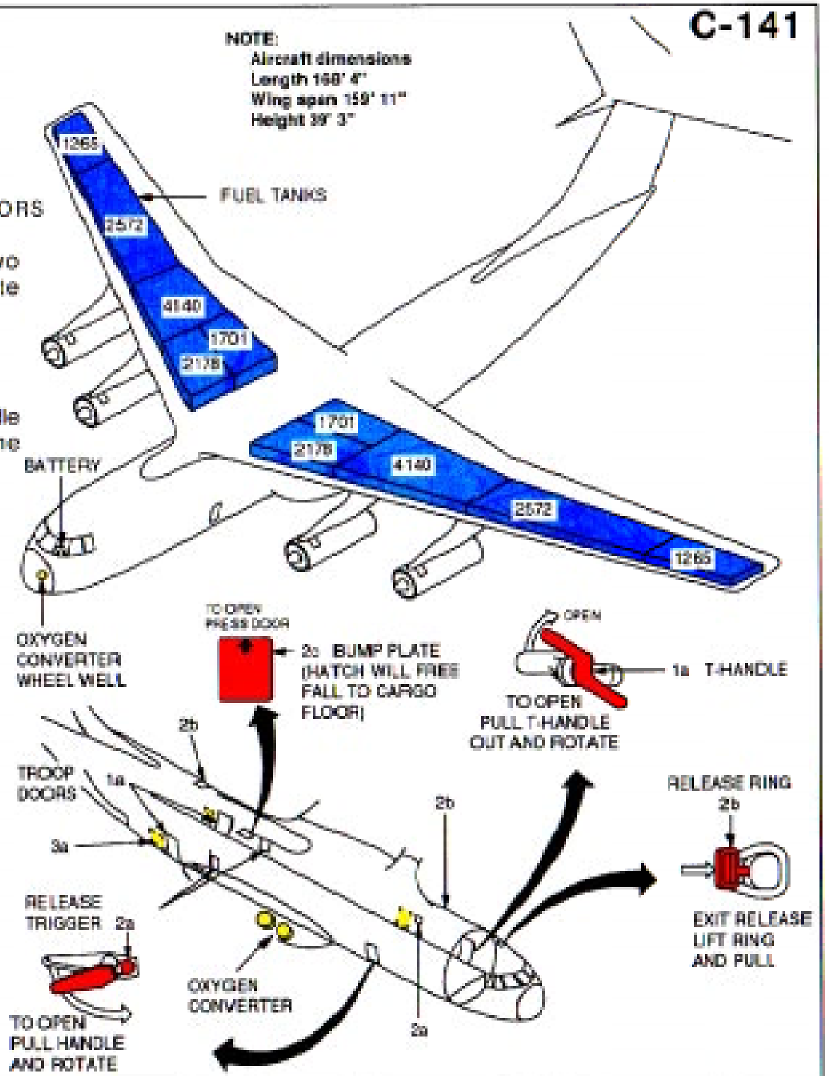
a. Press emergency exit release triggers, rotate handle counterclockwise and push hatch, located one forward and one aft wing root each side, inward.

b. Lift release ring and pull upward to open emergency exits, located top left forward of flight deck, top forward and aft of cargo compartment.

c. Strike rectangular bump plate, located above and inboard of hatch, to open.

3. CUT-IN

a. Cut-in areas located aft of left forward emergency exit and aft of both troop doors.



AIRCRAFT ENTRY - Continued

4. NORMAL ENTRY (NC-141A 61-2775 THRU 61-2777)

WARNING

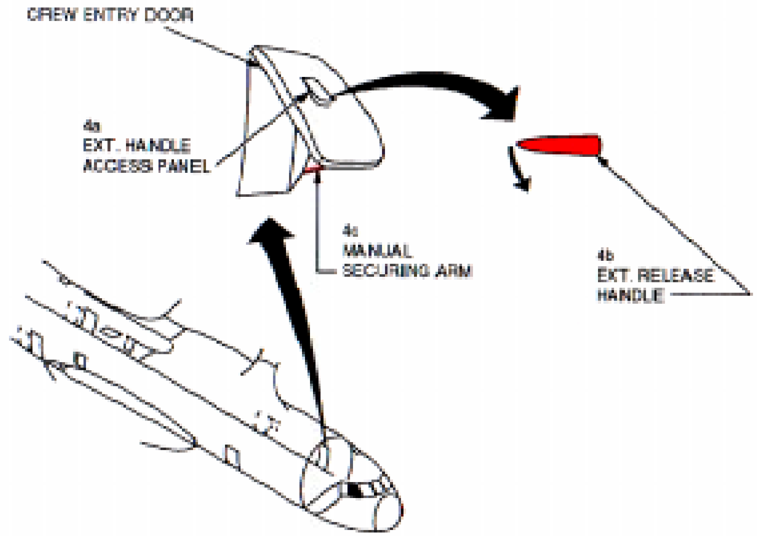
The aircraft must be completely depressurized before either the inside or outside door handle is operated. Opening doors or hatches while the aircraft is pressurized could cause serious injury to personnel.

a. Open external handle access panel, located center of crew entry and troop entrance doors.

b. Rotate external release handle downward the full length of its travel.

c. Pull door out and up, then lower manual securing arm, located on the lower inside aft corner of the door, and secure to a fitting on the door frame.

NOTE:
Emergency entry and cut-in procedures are the same on all C-141 aircraft.



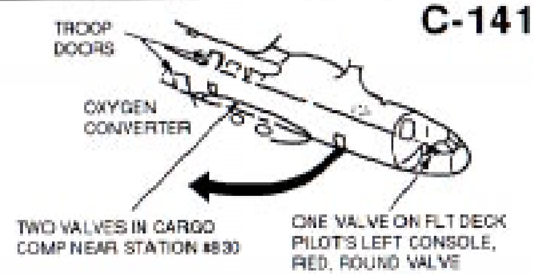
C-141

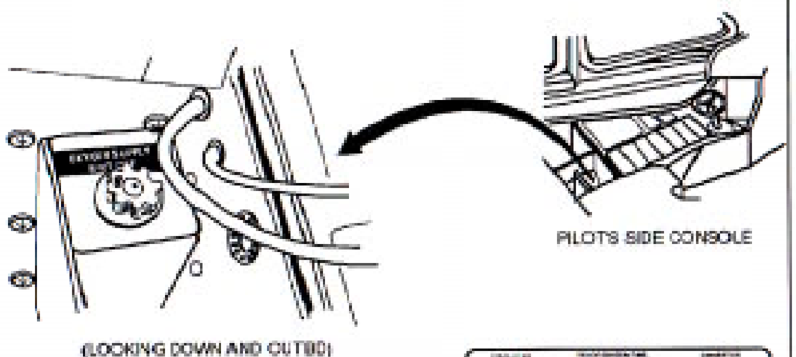
C-141 OXYGEN SHUTOFF VALVES

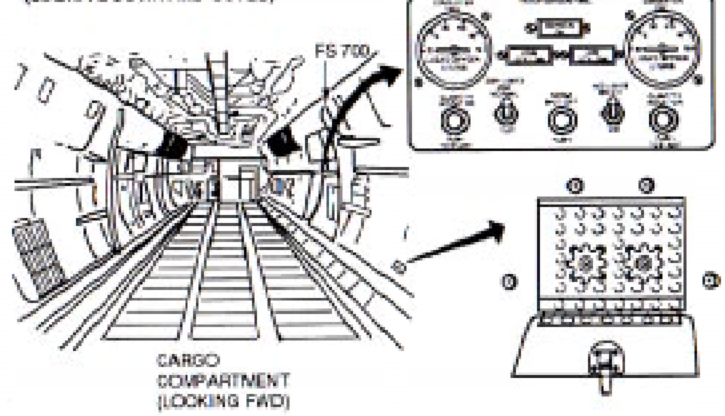
C-141

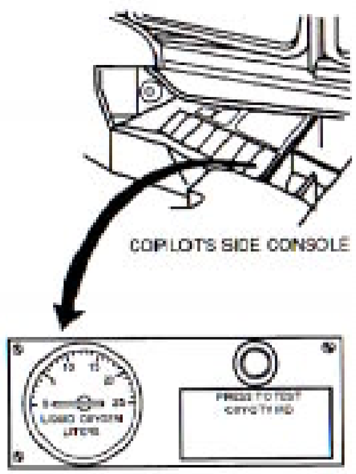
NOTE:

- Three valves--one Flight deck and two in Cargo compartment.
- Cargo compartment valves--near aircraft station #830 cargo bulkhead - right side 24" above cargo deck, 45' from normal crew entry door two valves in small compartment with door, troop seats may block the valves.
- Flight deck valve--pilot's left console, near thigh area--valve is painted red and is round.









ENGINE SHUTDOWN AND AIRCREW EXTRACTION

1. ENGINE SHUTDOWN

a. Pull engine fire control T-handles, located upper center portion of instrument panel.

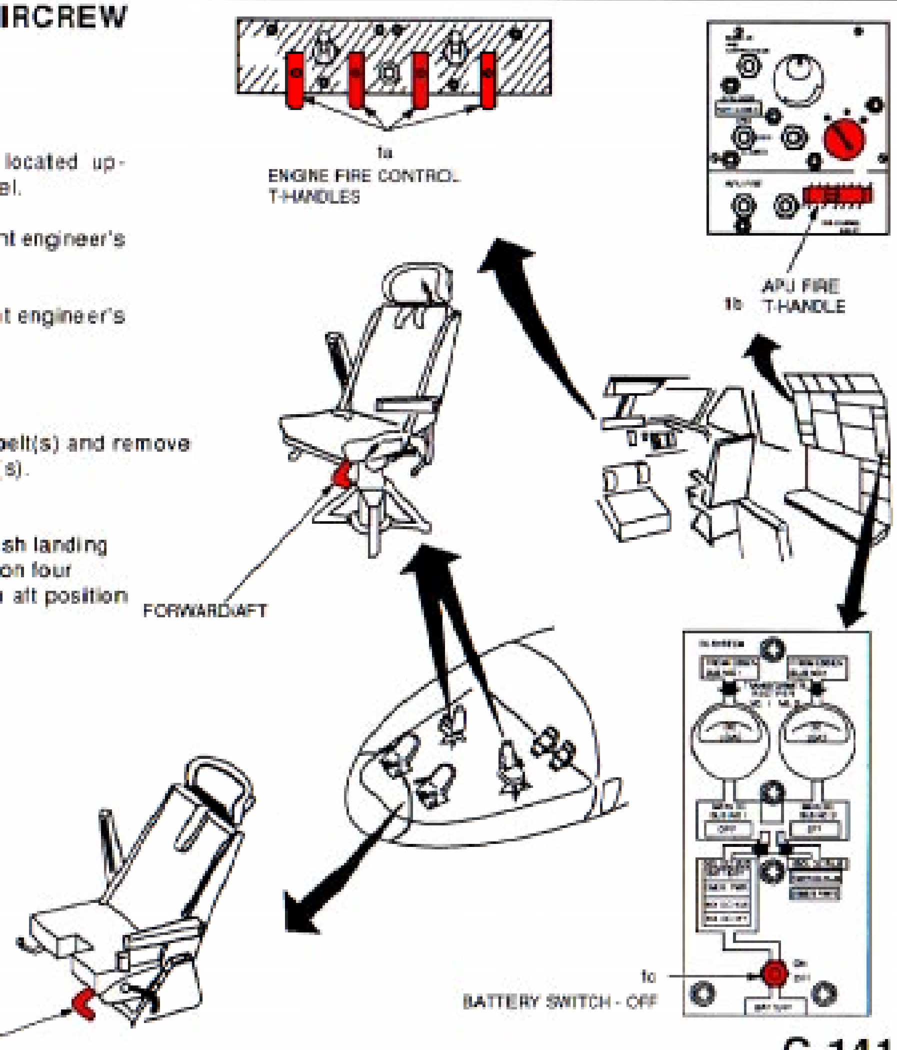
b. Pull APU fire T-handle, located on flight engineer's panel.

c. Place battery switch, located on flight engineer's electrical panel, to OFF position.

2. AIRCREW EXTRACTION

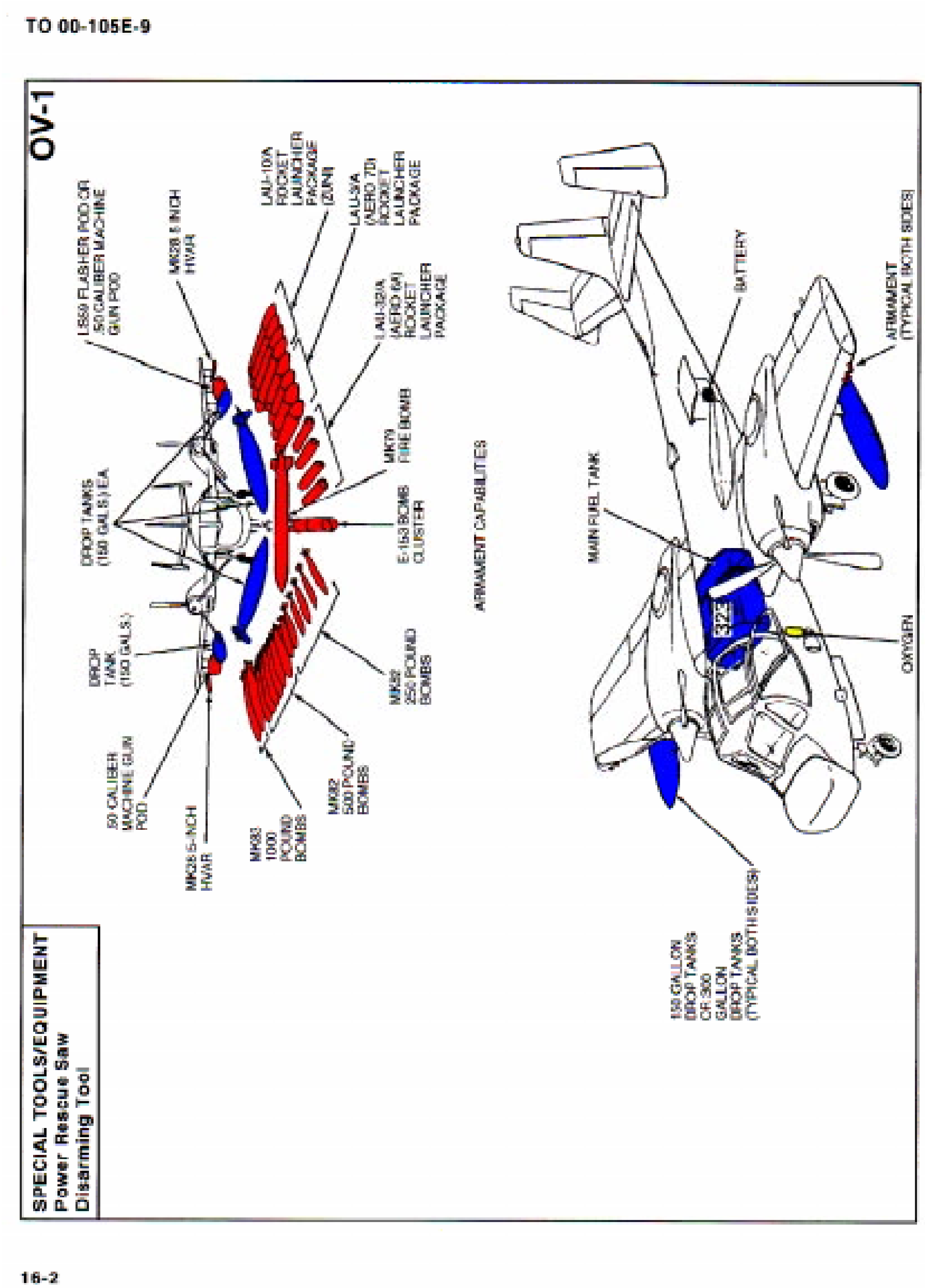
Raise seat armrest and unlatch lap belt(s) and remove shoulder harness from crewmember(s).

NOTE:
If tracks are not damaged during crash landing use adjustable seat control handles on four forward seats only to retract seats in aft position to aid in removing crewmember(s).



C-141

OV-1 Mohawk


TO 00-105E-9
OV-1
SPECIAL TOOLS/EQUIPMENT
Power Rescue Saw
Disarming Tool
ARMAMENT CAPABILITIES
DROP TANKS (150 GALS) EA.
DROP TANK (150 GALS.)
MK82 250 POUND BOMBS
MK82 500 POUND BOMBS
MK83 1000 POUND BOMBS
MK79 FIRE BOMB
MAIN FUEL TANK
BATTERY
OXYGEN
ARMAMENT (TYPICAL BOTH SIDES)
16-2

AIRCRAFT ENTRY
ALL MODELS

1. NORMAL ENTRY

a. Push ladder release, located on lower fuselage below entrance hatches, IN (this releases boarding ladder).

b. Lift exit release lock ring, located at bottom forward corner of pilot's and observer's entrance hatch, and rotate to unlock hatch.

c. Push forward end of hatch handle, located on bottom edge of hatch, in and pull aft end of handle out.

d. Lift entrance hatch to full up position.

2. EMERGENCY ENTRY

a. Lift exit release lock ring, located at bottom forward corner of pilot's and observer's entrance hatch and rotate to unlock.

b. Push forward end of hatch handle, located on bottom edge of hatch, in and pull aft end of handle out.

c. Lift entrance hatch to full open position.

NOTE:

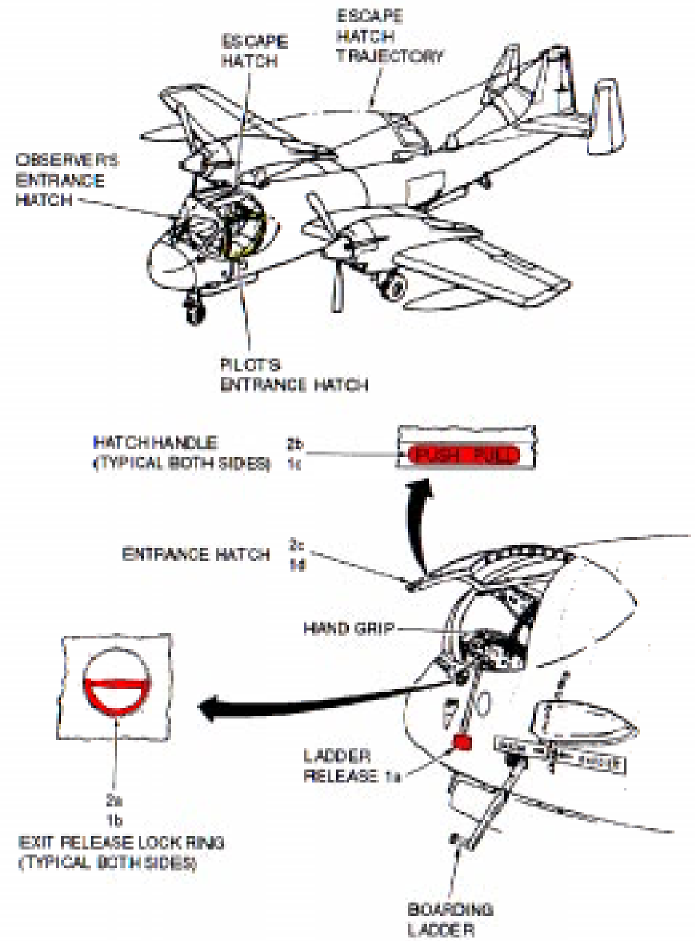
Pulling the escape hatch jettison T-handle accomplishes two operations, it unlatches the escape hatch and fires an air bottle which forcibly ejects the hatch.

WARNING

Make sure all personnel are clear of escape hatch area and trajectory path.

3. CUT-IN

a. Cut-in around entrance hatch frames as necessary.



OV-1

ENGINE SHUTDOWN, SAFETYING EJECTION SYSTEM, AND AIRCREW EXTRACTION

OV-1

1. ENGINE SHUTDOWN

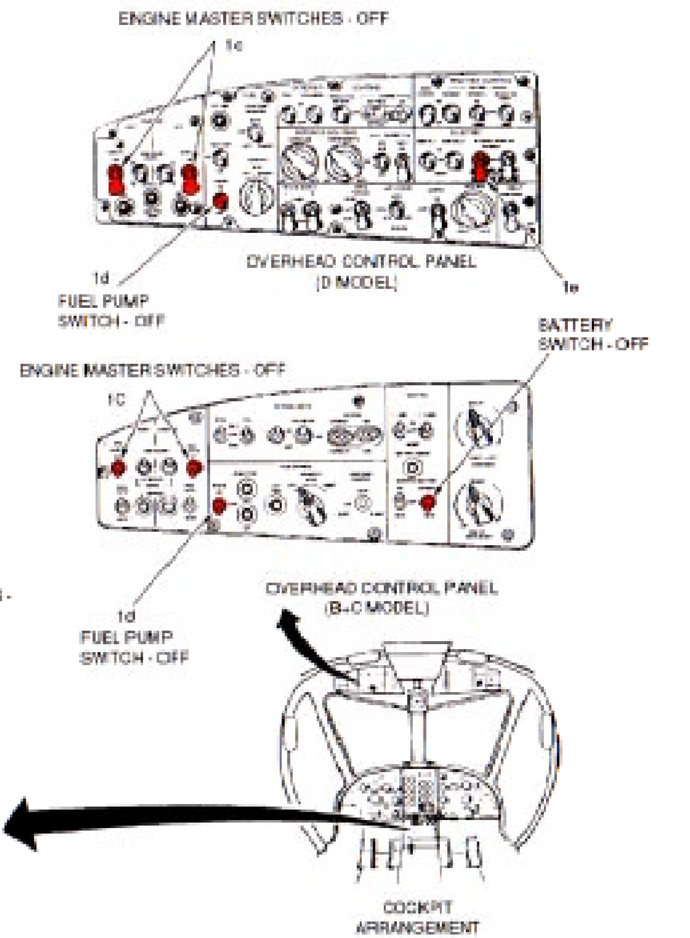
a. Retard power levers, located on control pedestal, to IDLE position.

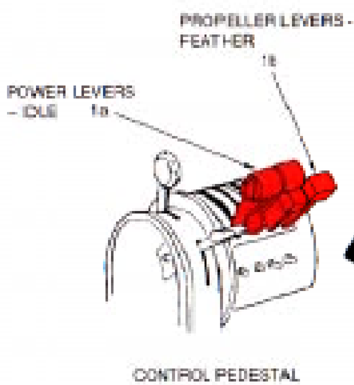
b. Pull propeller levers, located on control pedestal, aft to FEATHER position.

c. Position engine master switches, located on left overhead control panel, down to OFF.

d. Position fuel pump switches, located directly below master switches, to OFF.

e. Position battery switch, located on left overhead control panel, to OFF.





ENGINE SHUTDOWN, SAFETYING EJECTION SYSTEM, AND AIRCREW EXTRACTION - Continued

2. EMERGENCY SAFETYING EJECTION SEAT

a. Lift red tab of face blind locking mechanism, located on top of seat.

b. Lift lower firing handle safety guard, located on front center of seat, and install safety pin.

NOTE:
If safety pin is not available, a metal pin the diameter of a ten-penny nail can be used.

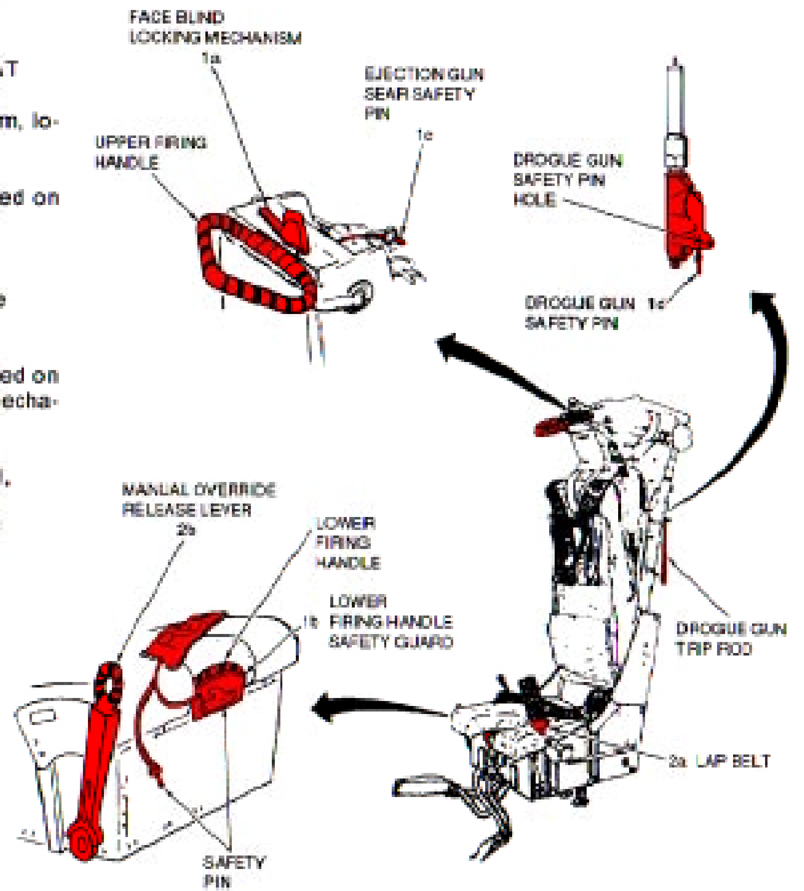
c. Insert safety pin in ejection gun sear, located on top of seat directly aft of face blind locking mechanism.

d. Remove safety pin from drogue gun trip rod, located on left rear of seat back, and insert this pin in the drogue gun container located above trip rod.

3. AIRCREW EXTRACTION

a. Unlatch lap belt and remove shoulder harness from crewmembers.

b. Move manual override release lever located right side of seat, to aft position.



OV-1

U-21 King Air

SPECIAL TOOLS/EQUIPMENT
Power Rescue Saw

AIRCRAFT ENTRY ALL MODELS

U-21

NOTE:
In the event main door or escape hatches are inaccessible, emergency entry may be gained by breaking through windshield.

1. NORMAL ENTRY

a. Rotate handle, located in center of passenger door on left side of aircraft down, and swing door down.

NOTE:
The main entrance door may be internally secured in closed position with safety chain. If door will not swing down after being unlatched, cut or break chain.

2. EMERGENCY ENTRY

NOTE:
Emergency escape hatch on right side of fuselage is only accessible on U-21A, G and RU-21E.

a. Cut in or break window in escape hatch to gain access to jettison handle, located on inside aft edge of hatch.

b. Pull yellow cover, located over jettison handle, down.

c. Press release button, located directly beneath jettison handle, in.

d. Pull jettison handle up and pull hatch out.

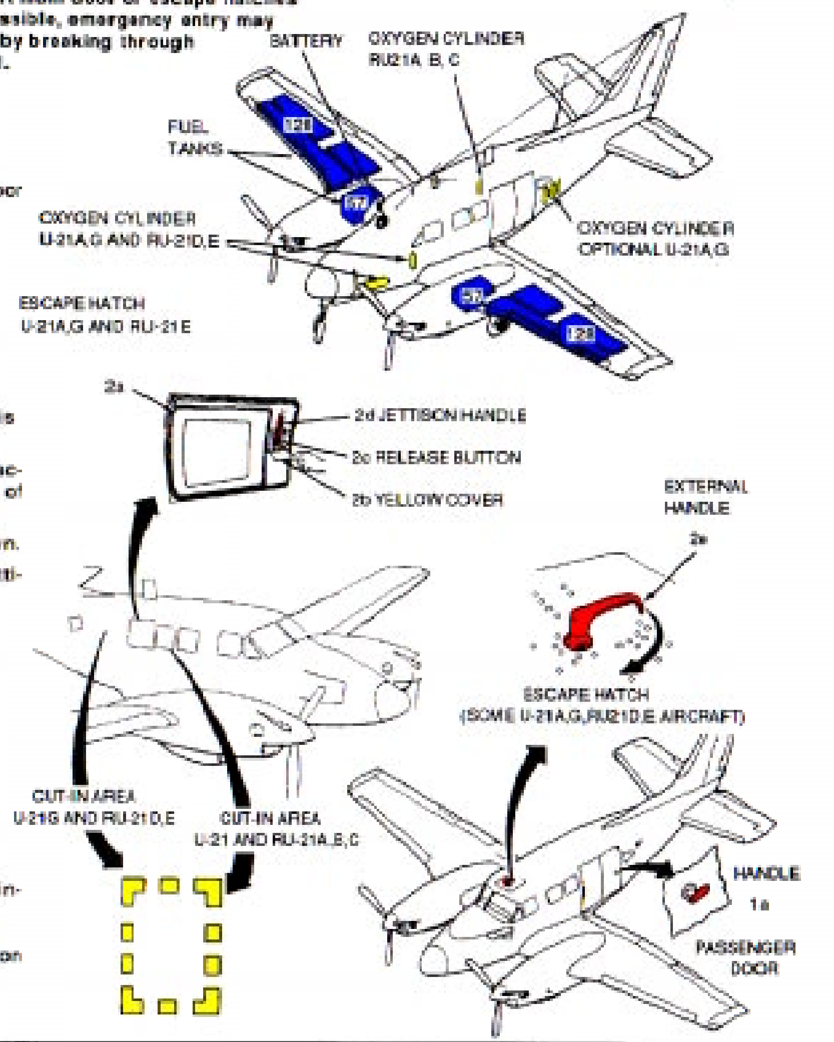
NOTE:
Some U-21A, U-21G, and RU-21E aircraft are equipped with an emergency entrance/escape hatch above cockpit area.

e. Rotate external handle, located on escape hatch, lift hatch off.

3. CUT-IN

a. Cut-in U-21A, RU-21A, B, and C forward of aft window on right hand side of fuselage as marked.

b. Cut-in U-21G, RU-21D, and E aft of aft window on right hand side of fuselage as marked.



ENGINE SHUTDOWN AND AIRCREW EXTRACTION

1. ENGINE SHUTDOWN

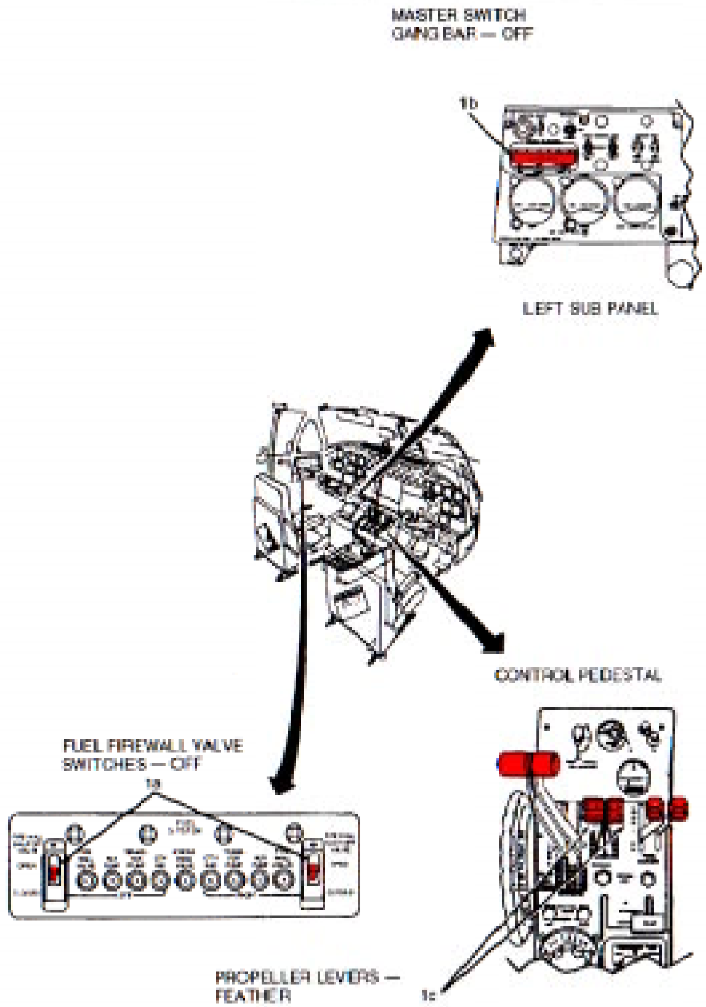
a. Position fuel firewall valve switches, located below the fuel management panel, down to OFF.

b. Push master switch gang bar, located on left subpanel, down to OFF position.

c. Pull propeller levers, located in center of control pedestal, aft to FEATHER position.

2. AIRCREW EXTRACTION

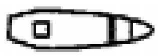
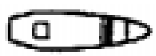
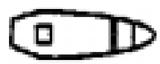
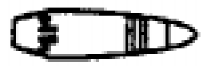
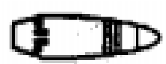
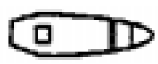
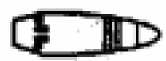
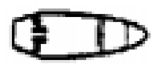
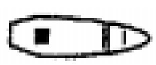
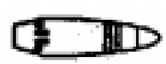
a. Unlatch lap belts and remove shoulder harness from crewmember(s).



U-21

Appendix C

Ammunition Identification Chart

Type of Projectile	Old System	New System
Toxic chemical agents (casualty agents)	Gray with green markings  Nonpersistent including G-series - 1 green band  Persistent including V-series - 2 green bands	Gray with green markings,yellow band if with explosive burster  1 green band
Irritant agents (riot-control agents)	Gray with red markings 1 red band Nonpersistent 	Gray with red markings,yellow band if with explosive burster  1 red band
Illuminating	Gray with white markings and band 	White with black markings, OD with white markings and band for separate loading projectiles  
Smoke	Gray with yellow markings and band 	Light green body WP, PWP  Light red markings, yellow band Other smoke  Black markings
Incendiary	Gray with purple markings and band 	Light red with black markings 
Counter-measure (leaflet)	OD with black markings 	Aluminum with black markings, brown band if with low-explosive burster 

Glossary

1LT first lieutenant

ACM air crew member

AFB Air Force base

AFFF aqueous film-forming foam

AIT advanced individual training

AL TRN alternate

ammo ammunition

amp amphere(s)

AO area of operation

approx approximately

APU auxiliary power unit

AR Army regulation

ARFF aircraft rescue fire fighting

ASG area support group

ASP ammunition supply point

ATM air turbine motor

attn attention

aux auxillary

AVGAS aviation gasoline

batt battery

BB bare base

BDOC base-defense operations center

BL boom line

BO base operability

BS boom station

BZ oksilidin

C Celsius

C^2 command and control

CA California

CAIRA chemical accident or incident response and assistance

CASP chemical ammunition supply point

CB Halon 1301

CBR chemical, biological, radiological

cc cubic centimeter(s)

CCD camouflage, concealment, and deception

CCE commercial construction equipment

cert certification

cfm cubic foot (feet) per minute

CFR Code of Federal Regulations

CG phosgene

chem chemical

CK cyanogen chloride

CL chlorine

CN chloroacetophenome

CNS central nervous system

COB collocated operating base

confinement The procedures taken to keep a material in a defined or local area.

containment The actions taken to keep a material in its container, such as to stop a release of the material or reduce the amount being released.

contaminant A hazardous material that physically remains on or in people, animals, the environment, or equipment, thereby creating a continuing risk of direct injury or a risk of exposure outside of the hot zone.

contamination The process of transferring a hazardous material from its source to people, animals, the environment, or equipment, which may act as a carrier.

c**ontrol** The defensive or offensive procedures, techniques, and methods used in the mitigation of a HAZMAT incident, including containment, extinguishment, and confinement.

control zones The designation of areas at a HAZMAT incident based on safety and the degree of hazard. Many terms are used to describe the zones involved in a HAZMAT incident. For this manual, these zones are defined as the hot, warm, and cold zones.

CONUS continental United States

CO_2 carbon dioxide

CP command post

CPG co-pilot gunner

CPR cardiopulmonary resuscitation

CS O-chlorobenzylidene malononitrile

CSA corps storage area

CSG corps support group

CTA common table of allowances

ctr center

CUCV commercial utility cargo vehicle

CW chemical warfare

CWDE chemical-warfare-defense equipment

DA diphenylchloroarsine

DA Department of the Army

DC ciphenylcyanoarsine

DC District of Columbia

decontamination The physical and/or chemical process of reducing and preventing the spread of contamination from persons and equipment used at a HAZMAT incident.

degradation (1) A chemical action involving the molecular breakdown of protective-clothing material or equipment due to contact with a chemical. (2) The molecular breakdown of the spilled or released material to render it less hazardous during control operations.

DD Department of Defense

DDESB Department of Defense Explosives Safety Board

dia diameter

disag disengage

disch discharge

DM Diphenylaminochloroarsine

DOD Department of Defense

DODD Department of Defense directive

DODI Deparment of Defense instruction

DOT Department of Transportation

DSA division support area

ea each

elec electrical/electric

emer emergency

EMS emergency medical support

eng engineer

engr engineer

environmental hazard A condition capable of posing an unreasonable risk to air, water, or soil quality and to plants or wildlife.

EOD explosive-ordnance disposal

EOR explosive-ordnance reconnaissance

EPC electrical power center

EPW enemy prisoner of war

ERDA Energy Research and Development Administration

et seq and the following ones

ext exterior

F Fahrenheit

FARP forward arming resupply point

FC-77 inert liquid

FCC fire communications center

FEDS flotation-equipment deployment system

FEMA Federal Emergency Management Agency

first responders Those personnel that are likely to witness or discover a HAZMAT release in the course of their normal duties, may be the first on the scene of an emergency involving HAZMATs. First responders are expected to recognize HAZMATs presence, protect themselves, call for trained personnel, and secure the area. In certain situations, first responders may be required to take actions to confine and contain spills. In a TO, the first responders will normally be the unit personnel that caused the material release or are responsible for the spill area.

FL Florida

FM tittanium tetrachloride

FM field manual

FOB forward operating base

fpm foot (feet) per minute

FPORI fire-protection operational-readiness inspection

FS fuselage station

FSS fire-suppression system

ft foot (feet)

FTX field training exercise

fus fuselage

fwd forward

G3 Assistant Chief of Staff, G3 (Operations and Plans)

gal gallon(s)

GB sarin

GCP gunner cockpit

gen generator

GPM gallon(s) per minute

GRD ground

GS general support

GSA General Services Administration

GTC auxiliary power unit

H levinstein mustard

hazard/hazardous Capable of posing an unreasonable risk to health, safety, or the environment capable of causing harm.

HAZMAT hazardous material: A substance (gas, liquid, or solid) in a quantity or form that may pose an unreasonable risk or is capable of causing harm.

HC hexachloroethane

HD distilled mustard

HHC headquarters and headquarters company

HMIS Hazardous Material Information System

HN host nation

HNS host-nation support

HP horsepower

HQ headquarters

ht height

HT mustard-T mixture

HTH bleach-in-water solution

htr heater

HVAR high-velocity aircraft rocket

HW hazardous waste

ID identification

IFSTA International Fire Service Training Association

in inch(es)

inbd inboard

Inc incorporated

incident commander The person responsible for all decisions relating to the management of the incident. The incident commander is in charge of the incident site. This individual will normally be the fire-fighting team HQ commander who has been trained in HAZMAT incidents. This individual may initially be the local commander who is responsible for the involved equipment, materials, or spill area until trained fire-fighting teams arrive at the site.

info information

Intergovernmental Maritime Consultative Organization Organization to consult in an emergency when an incident involves the release or potential release of HAZMATs, with or without fire.

ISB intermediate-support base

ISBN international standard book number

JP jet petroleum

km kilometer(s)

L lewisite

lb pound(s)

LA engineer fire-fighting HQ team

LB engineer fire-fighting fire-truck team

LC engineer fire-fighting water-truck team

LH left hand

LOS line of sight

LOX liquid oxygen

LRA local reproduction authorized

LSA logisitics-storage area

LT left

MA Massachusetts

MACI military-adapted commercial item

MACOM major Army command

max maximum

MD Maryland

MEDEVAC medical evacuation

MET mobile-equipment transport

METL mission-essential task list

MIL-HDBK military handbook

misc miscellaneous

mitigation Actions taken to prevent or reduce loss, human injury or death, environmental damage, and property damage due to the release or potential release of HAZMATs.

mm millimeter(s)

MO Missouri

MOB main operating base

monitoring equipment Instruments and devices used to identify and quantify contaminates.

MOPP mission-oriented protective posture

MOS military occupational specialty

MP military police

mph mile(s) per hour

MRE meals, ready to eat

NASP nuclear ammunition support point

nav navigator

NBC nuclear, biological, chemical

NCO noncommissioned officer

NEA nitrogen-enriched air

NFPA National Fire-Prevention Association

NH_3 basic ammonia

No. number

non ess bus nonessential BUS

norm normal

NP neptunium

OB observer

OBIGGS onboard inert gas-generating system

OD olive drab

OK Oklahoma

OSHA Occupational Safety and Health Act

outbd outboard

Pam pamphlet

PASS personal alert safety system

penetration The movement of a material through a suit's closures, such as zippers, buttonholes, seams, flaps, other design features of chemical protective clothing, and through punctures, cuts, and tears.

permeation A chemical action involving the movement of chemicals, on a molecular level, through intact material.

PFC private first class

PMCS preventive maintenance checks and services

P.O. post office

POL petroleum, oils, and lubricants

PPE personal protective equipment: Protective clothing and equipment that is designed to protect the wearer from heat and/or HAZMATs contacting the skin or eyes. Protective clothing is divided into four types: structural fire-fighting clothing, liquid-splash protective clothing, vapor protective clothing, and high-temperature protective clothing.

psi pound(s) per square inch

PT platinum

PTO power take-off

PTU power-train unit

PWP plasticized white phosphorous

pwr power

RADCON radiological contamination

recp receptacle

release Any situation leading to a HAZMAT, HW, or petroleum products being freed from its normal container. A release occurs when there is any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing of HAZMATs into the environment.

remediation Any action that permanently eliminates any threat that a release site may pose to public health or the environment.

removal Any action taken to deal with environmental emergencies.

REMT radiological emergency medical team

response That portion of incident management in which personnel are involved in controlling (defensively or offensively) a HAZMAT incident. The activities in the response portion of a HAZMAT incident include analyzing the incident, planning the response, implementing the planned response, and evaluating progress.

rev reverse

RH right hand

rpm revolution(s) per minute

RT right

sampling The process of collecting a representative amount of gas, liquid, or solid for analytical purposes.

SCBA self-contained breathing apparatus

SF-6 sulfurhexaflouride gas

SFO senior fire official

SGT sergeant

SM soldier's manual

SOLL special operations, low-level

SOP standing operating procedure

SPAAT hydraulic rescue drill

SPC specialist

spec specification

SSG staff sergeant

sta station

stabilization The point in an incident at which the adverse behavior of the HAZMATs is controlled.

STP soldier training publication

TAACOM theater Army area command

TAAMS The Army Maintenance Management System

TC training circular

TEA triethylaluminum

TEB triethylborine

TG trainer's guide

TH thorium

TO technical order

TO theater of operations

TOC tactical operations center

TM technical manual

TMP transportation motor pool

TOE table(s) of organization and equipment

TPA terephthalic acid

TPT tactical petroleum terminal

TRADOC United States Training and Doctrine Command

TSA theater storage area

TX Texas

TYP typical

UIC unit identification code

US United States (of America)

USAES United States Army Engineer School

USG United States gallon(s)

UXO unexploded ordnance

VX nerve agent

w/ with

WCDO war-consumable distribution objective

WL water line

WP white phosphorus

WRSK war-readiness spares kit

WS wing station

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By Order of the Secretary of the Army:

DENNIS J. REIMER
General, United States Army
Chief of Staff

Official:

JOEL B. HUDSON
Administrative Assistant to the
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